

REPORT

ON THE

COTTON PRODUCTION OF THE STATE OF TEXAS,

WITH A DISCUSSION OF

THE GENERAL AGRICULTURAL FEATURES OF THE STATE.

BY

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SPECIAL AGENT.

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LETTERS OF TRANSMITTAL.

BERKELEY, CALIFORNIA, *June 1, 1882.*

To the SUPERINTENDENT OF CENSUS.

DEAR SIR: I transmit herewith a report on the cotton production and agricultural features of the state of Texas, with illustrative maps, by Dr. R. H. Loughridge, special agent.

The data upon which this report and map are based are derived partly from personal observations by Dr. Loughridge (himself a former resident of the state), made during a three months' rapid reconnaissance under the auspices of the Census Office, and partly from personal correspondence and answers to schedules, as well as from all other available published sources. I thus feel assured that the information here conveyed may fairly claim to be, both as to correctness and completeness, considerably in advance of any former publications.

It will be noted that the map differs materially from that given by Mr. Roessler in 1874, nor do the descriptions given in the text agree altogether with those published by Mr. Oscar Loew about the same time; but being based upon closer and wider observations by one well qualified for the task, I think they will be found measurably in accordance with the facts, so far as the immense area of the state has permitted their ascertainment. A much more minute agricultural survey is, of course, eminently desirable.

Very respectfully,

E. W. HILGARD,
Special Agent in charge of Cotton Production.

Professor E. W. HILGARD,

Special Agent in charge of Cotton Production.

DEAR SIR: I have the honor to transmit to you the accompanying report on cotton production in Texas, embracing also a description of the agricultural features of the state, with other information that bears either directly or indirectly upon that great industry. In this report I have followed the plan adopted by you for use in all of the states under your charge, comprising—

Part I. The general description of the state, its separation into agricultural regions, and their respective descriptions.

Part II. Brief county descriptions, with abstracts from the reports of correspondents.

Part III. Details of cotton culture and production, as summarized exclusively from schedules of questions, answered by correspondents in each county.

Comparative tables of population, production of cotton, corn, and other crops, returned by the Tenth Census, as well as tables of chemical analyses made of characteristic soils of the state, accompany the report. The chemical analytical work was done at the laboratory of the University of Alabama, in Tuscaloosa, by Messrs. Henry McCalley, assistant in chemistry, University of Alabama; J. B. Durrett, of Tuscaloosa; Chappell Cory, of Selma, Alabama, and myself, the necessary supplies being furnished by the Census Office. Special determinations of humus and other elements have since been made under your instructions by Mr. George Colby, at the University of California, in Berkeley.

LETTERS OF TRANSMITTAL.

The material from which this report is compiled was obtained in part from data gathered in a general and hasty trip by myself in 1879 (from the 15th of August to the 25th of December) over parts of the state, visiting the chief points along the lines of travel from the east as far west as Graham, Breckenridge, Brownwood, San Saba, Austin, San Antonio, Cuero, and Indianola; in part from a previous residence in the southern portion of the state, and also from various publications at my command.

Early in 1880 printed schedules of questions on cotton culture were addressed to parties in each organized county of the state. Answers have been received from the greater number of the counties, and abstracts will be found in Parts II and III.

The paragraph on the geology of the state is perhaps more lengthy than the subject of the report would seem to justify; but as all the geological data exist only in detached portions in various publications (which are out of print), and as the rock structure of a country bears an important relation to its lands, I have, at your suggestion, given a general outline of the geological formations as far as was possible from the information at my command. The outlines of the Cretaceous and later formations were mostly obtained from personal observations.

Two maps accompany the report, one representing as nearly as possible the general outlines of the chief agricultural divisions of the state without giving the details and irregularities, which could only be obtained by a long term of examinations; the other showing the relative percentages of total area and cotton acreage. I have endeavored to keep the report within proper limits, and hence much is omitted that to some persons may appear to be important. This is especially so in Part II, where the county descriptions are made as concise as possible, though giving the chief agricultural features, and are limited to those counties in which cotton is produced.

The names of parties who have furnished important information, either by schedule or by letter, will be found in Part III. I would add that the postmasters in many of the counties have responded promptly to any notes of inquiry that I may have addressed them. Among the publications of more or less service to me were Thrall's *History of Texas*, *Description of Southwestern Texas*, reports of the United States topographical engineers, Pacific railroad reports, and Roessler's map of Texas.

Very respectfully,

R. H. LOUGHRIDGE,
Special Agent.

TABULATED RESULTS OF THE ENUMERATION.

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION.

TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS.

TABULATED RESULTS OF THE ENUMERATION.

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TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION.

COTTON-PRODUCING COUNTIES.

Counties.	Land area.	POPULATION.						TILLED LAND.		COTTON PRODUCTION.							Cotton acreage per square mile.	Bales per square mile.
		Total.	Male.	Female.	White.	Color'd.	Average per square mile.	Acres.	Per cent. of area.	Per cent. of tilled land.	Acres.	Bales.	Product per acre.					
													Fraction of bale.	Seed-cotton.	Lint.			
	Sq. mls.												500 lbs.	Lbs.	Lbs.			
The State.....	*262, 290	1, 591, 749	837, 840	753, 909	1, 197, 237	394, 512	6.1	7, 028, 536	4.5									
Cotton counties.....	126, 430	1, 526, 075	799, 480	723, 595	1, 135, 021	391, 054	12.1	7, 564, 456	9.3	28.7	2, 178, 435	805, 284	0.37	555	185	17.2	6.4	
Other counties, mostly western arid lands.	135, 860	65, 074	38, 360	27, 314	62, 216	3, 458	0.5	64, 080	0.1									
OAK, HICKORY, AND PINE UP- LANDS, WITH SOME PRAIRIES.																		
Cass.....	950	16, 724	8, 057	8, 067	10, 274	6, 450	17.6	83, 069	13.7	41.9	34, 822	10, 181	0.46	690	230	36.7	17.0	
Morris.....	260	5, 032	2, 626	2, 406	2, 988	2, 044	10.4	29, 100	17.5	36.5	10, 650	4, 880	0.46	690	230	41.0	18.8	
Titus.....	420	5, 959	3, 080	2, 870	4, 609	1, 350	14.2	30, 507	11.3	30.8	9, 395	4, 923	0.52	780	260	22.4	11.7	
Franklin.....	300	5, 280	2, 710	2, 561	4, 666	614	17.6	25, 528	13.3	33.9	8, 660	4, 048	0.47	705	235	28.9	13.5	
Hopkins.....	750	15, 461	8, 052	7, 409	13, 306	2, 155	20.6	85, 792	17.9	22.4	19, 242	8, 279	0.43	645	215	25.7	11.0	
Rains.....	270	3, 035	1, 586	1, 440	2, 785	250	11.2	16, 137	9.3	27.3	4, 399	1, 915	0.44	660	220	16.3	7.1	
Wood.....	700	11, 212	5, 870	5, 333	8, 653	2, 559	16.0	48, 786	10.9	31.7	15, 466	7, 381	0.48	720	240	22.1	10.5	
Camp.....	200	5, 931	3, 061	2, 870	3, 085	2, 846	20.7	33, 257	20.0	34.5	11, 473	5, 689	0.50	760	250	57.4	28.4	
Marion.....	420	10, 983	5, 590	5, 393	3, 759	7, 224	26.2	36, 978	13.8	46.2	17, 102	7, 515	0.44	580	220	40.7	17.9	
Upshur.....	520	10, 266	5, 295	4, 971	6, 884	3, 382	19.7	58, 063	17.4	33.4	19, 418	8, 023	0.41	615	205	37.3	15.4	
Gregg.....	280	8, 530	4, 400	4, 121	3, 817	4, 713	30.5	38, 585	21.5	35.7	13, 767	4, 590	0.33	495	165	49.2	16.4	
Harrison.....	900	25, 177	12, 753	12, 424	7, 976	17, 201	28.0	126, 462	22.0	36.9	46, 614	17, 019	0.38	570	190	51.8	19.6	
Panola.....	800	12, 219	6, 230	5, 983	7, 284	4, 035	15.3	71, 946	14.1	39.6	28, 480	10, 344	0.36	540	180	35.6	12.9	
Rusk.....	920	18, 986	9, 078	9, 308	10, 807	3, 179	20.6	99, 714	16.9	38.4	38, 326	11, 145	0.29	435	145	41.7	12.1	
Smith.....	960	21, 863	10, 992	10, 871	11, 506	10, 357	22.8	120, 016	19.7	37.8	45, 703	16, 285	0.36	540	180	47.6	17.0	
Van Zandt.....	840	12, 619	6, 601	6, 018	11, 456	1, 163	15.0	62, 597	11.6	28.1	17, 579	6, 957	0.40	600	200	20.9	8.3	
Henderson.....	960	9, 735	5, 221	4, 514	7, 641	2, 094	10.1	48, 641	7.9	32.4	15, 763	6, 159	0.39	585	195	16.4	6.4	
Navarro.....	1, 040	21, 702	11, 544	10, 158	16, 356	5, 846	20.9	136, 099	20.4	33.6	45, 716	12, 958	0.28	420	140	44.0	12.5	
Limestone.....	970	16, 246	8, 448	7, 708	13, 075	3, 171	16.7	84, 299	13.6	42.1	35, 519	9, 037	0.25	375	125	36.6	9.3	
Freestone.....	880	14, 921	7, 656	7, 265	8, 269	6, 652	17.0	100, 693	17.9	31.2	31, 372	8, 132	0.26	390	130	35.7	9.3	
Anderson.....	1, 600	17, 395	9, 059	8, 342	9, 619	7, 776	17.4	78, 814	12.3	30.1	23, 725	7, 548	0.32	480	160	23.7	7.5	
Cherokee.....	1, 000	16, 723	8, 442	8, 281	11, 014	5, 709	16.7	90, 480	14.1	32.8	29, 708	9, 813	0.33	495	165	23.7	9.8	
Nacogdoches.....	970	11, 500	5, 960	5, 630	8, 550	3, 040	11.9	66, 863	10.8	25.1	16, 762	4, 791	0.29	435	145	17.3	4.9	
Shelby.....	800	9, 523	4, 910	4, 613	7, 369	2, 154	11.9	44, 764	8.7	36.0	16, 136	6, 171	0.38	570	190	20.2	7.7	
Sabine.....	570	4, 161	2, 106	2, 055	3, 168	903	7.3	15, 631	4.3	33.6	5, 252	1, 705	0.32	480	160	9.2	3.0	
San Augustine.....	580	5, 084	2, 617	2, 467	3, 169	1, 915	9.1	25, 130	7.0	28.7	7, 219	2, 757	0.38	570	190	12.9	4.9	
Angelina.....	880	5, 239	2, 660	2, 579	4, 405	834	6.0	19, 729	3.5	28.8	5, 681	2, 319	0.41	615	205	6.5	2.6	
Trinity.....	710	4, 915	2, 496	2, 419	3, 753	1, 162	6.9	23, 491	5.2	29.0	6, 862	2, 666	0.39	585	195	9.6	3.8	
Polk.....	1, 100	7, 189	3, 611	3, 578	4, 342	2, 847	6.5	23, 865	3.4	30.3	7, 229	3, 629	0.50	750	250	6.6	3.3	
Houston.....	1, 170	16, 702	8, 586	8, 116	9, 465	7, 237	14.3	73, 884	9.9	36.3	26, 819	9, 730	0.36	540	180	22.9	8.3	
Leon.....	1, 000	12, 817	6, 024	6, 193	7, 707	5, 110	12.8	68, 073	10.6	34.6	23, 578	7, 360	0.31	465	155	23.6	7.4	
Robertson.....	870	22, 333	11, 821	10, 562	11, 366	10, 997	25.7	117, 990	21.2	42.3	49, 854	18, 080	0.36	540	180	57.3	20.8	
Madison.....	460	5, 395	2, 765	2, 630	3, 693	1, 702	11.7	24, 268	8.2	37.7	9, 158	2, 656	0.29	435	145	10.9	5.8	
Walker.....	760	12, 024	6, 733	5, 291	5, 257	6, 767	15.8	51, 129	10.5	39.4	20, 162	6, 441	0.32	480	160	26.5	8.5	
Grimes.....	780	18, 603	9, 437	9, 166	8, 323	10, 280	23.9	79, 877	16.0	45.0	35, 984	11, 701	0.33	495	165	46.1	15.0	
Brazos.....	520	13, 576	7, 132	6, 444	7, 325	6, 251	26.1	61, 803	18.6	45.4	28, 044	9, 743	0.35	525	175	53.9	18.7	
Burleson.....	650	9, 243	4, 898	4, 345	5, 856	3, 837	14.2	47, 190	11.3	32.4	15, 298	5, 965	0.39	585	195	23.5	9.2	
Milam.....	990	18, 659	9, 750	8, 909	14, 723	3, 936	18.8	91, 032	14.4	41.2	37, 473	10, 844	0.29	435	145	37.8	11.0	
Lee.....	600	8, 937	4, 632	4, 305	6, 981	1, 956	14.9	42, 331	11.0	37.0	15, 662	5, 526	0.35	525	175	26.1	9.2	
Bastrop.....	900	17, 215	9, 000	8, 215	9, 909	7, 306	10.1	85, 732	14.9	41.7	35, 730	14, 714	0.41	615	205	39.7	16.3	
Gonzales.....	1, 070	14, 840	7, 687	7, 153	9, 974	4, 866	13.9	88, 638	12.9	25.7	22, 729	7, 511	0.38	495	165	21.2	7.0	
Wilson.....	790	7, 118	3, 733	3, 335	6, 197	921	9.0	33, 642	6.7	17.3	5, 814	1, 874	0.32	480	160	7.4	2.4	
Total.....	31, 490	511, 212	264, 786	246, 426	320, 881	190, 331	16.2	2, 591, 485	12.9	35.3	914, 305	325, 654	0.36	540	180	28.0	10.3	
LONG-LEAF PINE REGION.																		
Newton.....	870	4, 359	2, 223	2, 136	2, 852	1, 507	5.0	13, 450	2.4	26.1	3, 510	1, 332	0.38	570	190	4.0	1.5	
Jasper.....	970	5, 779	2, 919	2, 860	3, 241	2, 538	6.0	17, 804	2.8	25.7	4, 455	1, 410	0.32	480	160	4.6	1.5	
Orange.....	390	2, 938	1, 610	1, 328	2, 475	403	7.5	2, 023	0.8	3.3	66	22	0.33	495	165	0.2	0.1	
Hardin.....	820	1, 870	937	933	1, 634	236	2.3	3, 363	0.6	7.8	264	103	0.39	585	195	0.3	0.1	
Tyler.....	920	5, 825	2, 921	2, 904	4, 323	1, 502	6.3	19, 371	3.3	28.4	5, 504	2, 543	0.46	690	230	6.0	2.3	
Liberty.....	1, 170	4, 999	2, 615	2, 384	2, 565	2, 434	4.3	13, 027	1.7	28.9	3, 768	1, 352	0.49	735	245	3.2	1.6	
Total.....	5, 140	25, 770	13, 225	12, 545	17, 090	8, 680	5.0	63, 543	2.1	25.6	17, 567	7, 262	0.41	615	205	3.4	1.4	

* The additional water area is 3,490 square miles, comprising coast waters (bays, gulfs, etc.), 2,510 square miles; rivers, 800 square miles; lakes and ponds, 180 square miles.

COTTON PRODUCTION IN TEXAS.

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION—Continued.

COTTON-PRODUCING COUNTIES—Continued.

Counties.	Land area.	POPULATION.						TILLED LAND.			COTTON PRODUCTION.							Cotton acreage per square mile.	Bales per square mile.
		Total.	Male.	Female.	White.	Color'd.	Average per square mile.	Acres.	Per cent. of area.	Per cent. of tilled land.	Acres.	Bales.	Product per acre.						
													Fraction of bale.	Seed-cot- ton.	Lint.				
SOUTHERN AND COAST PRAIRIE REGION.																			
Region east of the Brazos river.		Sq. mls.												500 lbs.	Lbs.	Lbs.			
San Jacinto.....	640	6,186	3,109	3,077	2,851	3,335	9.7	25,660	6.3	38.3	9,840	5,354	0.54	810	270	15.4	8.4		
Montgomery.....	1,050	10,154	5,248	4,906	4,926	5,228	9.7	54,785	8.2	24.3	13,311	4,092	0.31	465	155	12.7	3.9		
Waller.....	500	9,024	4,049	4,375	3,192	5,832	18.0	31,665	9.9	31.9	10,104	3,023	0.39	585	195	20.2	7.8		
Harris.....	1,800	27,985	14,074	13,911	17,100	10,825	15.5	25,123	2.2	17.7	4,440	1,892	0.43	645	215	2.5	1.1		
Galveston.....	670	24,121	12,099	12,022	13,454	5,667	36.0	2,790	0.7	10.4	289	186	0.47	705	235	0.4	0.2		
Chambers.....	850	2,187	1,180	1,007	1,404	603	2.6	3,336	0.6	4.2	140	91	0.05	975	325	0.2	0.1		
Jefferson.....	1,000	3,489	1,826	1,663	2,290	1,199	3.5	4,796	0.7	2.8	133	77	0.58	870	290	0.1	0.1		
Total.....	6,510	83,146	42,185	40,961	50,367	32,779	12.8	148,155	3.0	25.8	38,257	15,505	0.41	615	205	5.9	2.4		
Region west of the Brazos river.																			
Washington.....	600	27,565	14,028	13,537	12,845	14,720	45.9	139,712	36.3	42.0	58,705	20,692	0.35	525	175	97.8	34.5		
Austin.....	700	14,429	7,419	7,010	10,490	3,939	20.6	73,492	16.4	42.6	31,321	13,185	0.42	630	210	44.7	18.8		
Fayette.....	900	27,996	14,487	13,509	19,107	8,829	29.2	137,218	22.3	42.5	58,353	24,760	0.42	630	210	60.8	25.8		
Colorado.....	900	16,673	8,476	8,197	8,987	7,686	18.5	96,865	16.8	34.1	32,994	15,552	0.47	705	235	36.7	17.3		
Lavaca.....	1,000	13,641	6,965	6,676	10,221	3,420	13.6	94,970	14.8	27.1	25,728	9,970	0.39	585	195	25.7	10.0		
De Witt.....	900	10,082	5,141	4,941	7,144	2,938	11.2	41,792	7.3	18.2	7,025	2,183	0.29	435	145	8.5	2.4		
Victoria.....	880	6,289	3,105	3,184	3,883	2,406	7.1	24,395	4.3	7.1	1,739	730	0.42	630	210	2.0	0.8		
Jackson.....	900	2,723	1,393	1,330	1,310	1,413	3.0	8,829	1.5	7.3	648	202	0.31	465	155	0.7	0.2		
Matagorda.....	1,400	3,940	2,055	1,885	1,416	2,524	2.8	17,917	2.0	19.2	3,435	2,096	0.61	915	305	2.5	1.5		
Calhoun.....	900	1,739	869	870	1,192	547	1.8	778	0.1										
Karnes.....	730	3,270	1,742	1,528	2,780	490	4.5	51,393	11.0	3.1	1,007	283	0.18	270	90	2.2	0.4		
Atascosa.....	1,200	4,217	2,279	1,938	3,938	279	3.5	14,744	1.9	9.6	1,422	469	0.33	495	165	1.2	0.4		
Frio.....	1,000	2,130	1,109	931	2,065	65	2.1	5,622	0.9	9.7	543	156	0.29	495	145	0.5	0.2		
Live Oak.....	1,100	1,994	1,057	937	1,918	76	1.8	3,546	0.5	0.5	16	4	0.25	375	125				
Bee.....	890	2,298	1,231	1,067	2,145	153	2.6	7,188	1.3	0.6	44	9	0.20	300	100				
Goliad.....	820	5,832	2,998	2,834	4,106	1,606	7.1	30,547	5.8	5.8	1,779	728	0.41	615	205	2.2	0.9		
Refugio.....	850	1,535	833	752	1,249	336	1.9	2,955	0.5	1.2	36	15	0.42	630	210				
San Patricio.....	730	1,010	535	475	936	74	1.4	1,309	0.3	0.5	6	2	0.33	495	165				
Total.....	16,520	147,413	75,812	71,601	95,852	51,561	8.9	753,272	7.1	30.0	226,001	91,048	0.40	600	200	18.7	5.5		
CENTRAL BLACK PRAIRIE REGION.																			
Cooke.....	900	20,391	10,888	9,503	10,560	831	22.7	98,160	17.0	28.3	27,795	11,547	0.42	630	210	30.0	12.8		
Montague.....	890	11,257	6,076	5,181	11,210	47	12.6	48,834	8.6	22.4	10,947	4,172	0.38	570	190	12.3	4.7		
Wise.....	900	16,601	8,871	7,730	16,436	165	18.4	84,081	14.6	25.4	21,352	7,231	0.34	510	170	23.7	8.0		
Denton.....	900	18,143	9,730	8,413	17,071	1,072	20.2	110,220	19.1	27.0	29,785	11,568	0.39	585	195	33.1	12.9		
Collin.....	880	25,983	14,100	11,883	24,003	1,980	29.5	170,577	30.3	28.3	48,236	22,145	0.40	600	230	54.3	25.2		
Hunt.....	870	17,230	9,104	8,066	10,015	1,215	19.8	111,797	20.1	23.2	25,906	10,805	0.42	630	210	29.3	12.4		
Delta.....	260	5,597	2,961	2,636	4,999	598	21.5	29,389	17.7	30.4	8,940	4,911	0.55	825	275	34.4	18.9		
Kaufman.....	830	15,448	8,191	7,257	13,471	1,977	18.6	34,317	15.9	31.6	26,059	10,668	0.40	600	200	32.1	12.9		
Rockwall.....	150	2,984	1,615	1,369	2,898	86	19.9	26,443	27.5	21.9	5,780	2,630	0.45	675	225	38.6	17.5		
Dallas.....	900	33,488	18,079	15,409	28,530	4,958	37.2	190,542	38.1	23.3	44,377	21,469	0.52	780	260	40.3	23.9		
Tarrant.....	900	24,671	13,292	11,379	22,488	2,183	27.4	143,440	24.9	19.4	27,821	10,950	0.39	585	195	30.0	12.2		
Parker.....	900	15,870	8,673	7,197	15,250	620	17.6	78,707	13.7	19.1	15,036	4,454	0.30	450	150	16.7	4.9		
Hood.....	490	6,125	3,217	2,908	5,027	198	12.5	34,319	11.1	20.5	7,139	1,960	0.28	420	140	14.6	4.0		
Erath.....	1,000	11,796	6,222	5,574	11,539	257	11.8	61,047	9.6	23.1	14,220	2,857	0.20	300	100	14.2	2.9		
Somervell.....	200	2,649	1,396	1,253	2,621	28	13.2	15,609	12.2	25.8	4,030	1,066	0.26	399	130	20.2	5.3		
Johnson.....	690	17,911	9,529	8,382	17,337	574	26.0	134,842	30.5	30.0	40,446	13,778	0.34	510	170	58.6	20.0		
Ellis.....	950	21,294	11,320	9,974	18,755	2,539	22.4	172,084	23.3	30.3	52,172	18,956	0.30	540	180	54.9	20.0		
Hill.....	1,000	16,554	8,872	7,682	15,256	1,298	16.6	135,381	21.2	28.5	38,535	8,369	0.22	330	110	38.5	8.4		
Bosque.....	1,000	11,217	6,058	5,159	10,718	490	11.2	68,931	10.8	28.5	19,024	3,833	0.20	300	100	19.6	3.8		
Hamilton.....	980	6,365	3,365	3,000	6,341	24	6.5	35,604	5.7	19.2	6,840	1,147	0.17	255	85	7.0	1.2		
Lampasas.....	850	5,421	2,842	2,579	5,248	173	6.4	28,435	5.2	16.2	4,611	628	0.14	210	70	5.4	0.7		
Coryell.....	950	10,924	5,677	5,247	10,539	385	11.5	73,763	13.0	25.0	19,688	3,331	0.17	255	85	20.7	3.5		
McLennan.....	1,080	26,934	14,001	12,933	19,276	7,658	24.9	203,882	29.5	26.2	53,394	12,777	0.24	360	120	49.4	11.8		
Falls.....	780	16,240	8,524	7,716	9,565	6,675	20.8	114,867	23.0	34.5	39,669	12,495	0.32	480	160	50.9	13.0		
Bell.....	1,000	20,518	10,705	9,813	18,733	1,735	20.5	129,039	20.2	29.3	37,826	9,217	0.24	390	120	37.3	9.2		
Williamson.....	1,100	15,155	8,054	7,101	13,520	1,635	13.8	141,802	20.2	13.1	18,528	4,217	0.23	345	115	10.3	3.3		
Travis.....	1,000	27,028	14,166	12,862	18,410	8,618	27.0	86,724	13.6	34.0	20,500	9,271	0.31	465	155	29.5	9.3		
Caldwell.....	540	11,757	6,111	5,046	7,723	4,034	21.8	54,914	15.9	34.4	18,906	7,609	0.40	600	200	35.0	14.1		

TABULATED RESULTS OF THE ENUMERATION.

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TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION—Continued.

COTTON-PRODUCING COUNTIES—Continued.

Counties.	Land area.	POPULATION.						TILLED LAND.			COTTON PRODUCTION.							Cotton acreage per square mile.	Bales per square mile.
		Total.	Male.	Female.	White.	Color'd.	Average per square mile.	Acres.	Per cent. of area.	Per cent. of tilled land.	Acres.	Bales.	Product per acre.						
													Fraction of bale.	Seed-cotton.	Lint.				
CENTRAL BLACK PRAIRIE REGION—continued.		Sq. mls.												500 lbs.	Lbs.	Lbs.			
Hayes.....	080	7,555	4,069	3,486	6,076	1,479	11.1	32,711	7.5	30.2	9,868	3,441	0.35	525	175	14.5	5.1		
Blanco.....	710	3,523	1,948	1,635	3,415	168	5.0	10,090	3.5	18.9	3,039	690	0.23	345	115	4.3	1.0		
Gillespie.....	980	5,228	2,764	2,464	5,096	132	5.3	10,127	1.6	40.3	4,082	767	0.19	285	95	4.2	0.8		
Kerr.....	1,100	2,168	1,145	1,023	2,075	93	2.0	9,481	1.3	4.0	409	72	0.15	225	75	0.4	0.1		
Kendall.....	670	2,763	1,492	1,271	2,588	175	4.1	9,410	2.2	10.2	1,808	286	0.16	240	80	2.7	0.4		
Comal.....	670	5,546	2,804	2,682	5,276	270	8.3	33,414	7.8	17.5	5,860	2,102	0.36	540	180	8.7	1.1		
Guadalupe.....	710	12,202	6,370	5,832	8,747	3,455	17.2	69,680	15.3	23.6	10,469	6,531	0.40	600	200	23.2	9.2		
Bexar.....	1,180	30,470	16,083	14,387	26,003	3,867	25.8	54,200	7.2	7.9	4,273	1,543	0.36	540	180	3.6	1.3		
Medina.....	1,300	4,492	2,396	2,096	4,209	283	8.5	16,987	2.0	4.0	685	289	0.42	630	210	0.5	0.2		
Bandera.....	1,000	2,158	1,116	1,042	2,127	81	2.2	11,623	1.8	1.9	223	52	0.23	345	115	0.2	0.1		
Uvalde.....	1,550	2,541	1,425	1,116	2,478	63	1.6	3,466	0.3	4.1	141	53	0.33	570	190	0.1	.....	
Total.....	33,440	514,257	273,371	240,886	452,179	62,078	15.4	2,941,154	13.7	25.3	744,085	249,893	0.34	510	170	22.3	7.5		
NORTHWESTERN RED-LOAM PRAIRIE REGION.																			
Clay.....	1,100	5,045	2,764	2,281	5,019	26	4.6	24,538	3.5	13.4	3,289	1,155	0.35	525	175	3.0	1.1		
Wichita.....	590	433	298	135	416	17	0.7	2,473	0.7	4.2	103	43	0.42	630	210	0.2	.....	
Baylor.....	900	715	426	289	709	6	0.8	2,489	0.4	13.1	326	83	0.25	375	125	0.4	0.1		
Archer.....	900	596	354	242	589	7	0.7	3,614	0.6	2.9	104	43	0.41	615	205	0.1	.....	
Jack.....	870	6,626	3,574	3,052	6,508	118	7.6	29,338	5.3	16.2	4,761	1,444	0.30	450	150	5.5	1.7		
Young.....	900	4,726	2,538	2,188	4,709	17	5.3	23,122	4.0	8.9	2,049	554	0.27	405	135	2.3	0.6		
Throckmorton.....	900	711	413	298	699	12	0.8	3,741	0.6	1.4	51	10	0.20	300	100	0.1	.....	
Jones.....	900	546	320	226	542	4	0.6	1,191	0.2	6.8	81	19	0.23	345	115	0.1	.....	
Shackelford.....	900	2,037	1,199	838	1,781	256	2.3	2,207	0.4	1.0	23	5	0.22	330	110	.....	.....
Stephens.....	900	4,725	2,506	2,160	4,700	25	5.3	18,042	3.1	3.8	666	137	0.20	300	100	0.8	0.2		
Palo Pinto.....	960	5,885	3,330	2,555	5,797	88	6.1	24,468	4.0	17.5	4,292	885	0.21	315	105	4.5	0.9		
Eastland.....	900	4,855	2,681	2,174	4,837	18	5.4	19,752	3.4	16.5	3,264	742	0.23	345	115	3.0	0.8		
Callahan.....	900	3,453	2,028	1,425	3,419	34	3.8	8,471	1.5	5.1	434	80	0.20	300	100	0.5	0.1		
Coleman.....	1,240	3,603	2,028	1,575	3,568	35	2.9	17,017	2.1	4.7	796	244	0.31	465	155	0.6	0.2		
Brown.....	1,200	8,414	4,480	3,934	8,291	123	7.0	45,655	5.9	9.3	4,254	998	0.23	345	115	3.5	0.8		
Comanche.....	930	8,608	4,500	4,048	8,529	79	9.3	44,191	7.4	21.0	9,301	2,098	0.23	345	115	10.0	2.3		
San Saba.....	1,130	5,624	2,758	2,566	5,183	141	4.7	21,075	2.9	13.4	2,819	400	0.14	210	70	2.5	0.4		
McCulloch.....	1,000	1,533	869	664	1,511	22	1.5	2,806	0.4	5.1	145	54	0.27	555	185	0.1	0.1		
Mason.....	900	2,655	1,462	1,193	2,614	41	3.0	17,224	3.0	1.5	262	64	0.24	360	120	0.3	0.1		
Llano.....	900	4,962	2,636	2,326	4,896	66	5.5	17,533	3.0	12.8	2,247	469	0.21	315	105	2.5	0.5		
Burnet.....	1,000	6,855	3,621	3,234	6,607	248	6.9	37,168	5.3	18.9	7,024	1,399	0.20	300	100	7.0	1.4		
Total.....	10,920	82,307	44,905	37,402	80,924	1,383	4.1	366,195	2.9	12.6	46,301	10,931	0.24	360	120	2.3	0.5		
RED RIVER ALLUVIAL COUNTIES.																			
Bowie.....	900	10,965	5,817	5,148	6,628	4,337	12.2	38,576	6.7	30.1	11,599	7,958	0.69	1,035	345	12.9	8.8		
Red River.....	1,060	17,194	8,961	8,233	10,012	6,282	16.2	83,005	12.2	37.7	31,291	17,669	0.56	840	280	29.5	16.7		
Lamar.....	900	27,193	14,139	13,054	20,445	6,748	30.2	123,538	21.4	32.7	40,390	24,623	0.61	915	305	44.9	27.4		
Fannin.....	890	25,501	13,697	11,804	22,081	3,420	28.7	156,725	27.5	23.6	44,813	22,386	0.50	750	250	50.4	25.2		
Grayson.....	960	38,108	20,069	18,039	33,540	4,559	39.7	185,532	30.2	22.3	41,339	19,166	0.46	690	230	43.1	20.0		
Total.....	4,710	118,961	62,633	56,278	93,615	25,346	25.3	587,371	19.5	28.8	169,432	91,802	0.54	810	270	36.0	19.5		
BRAZOS ALLUVIAL OR SUGAR-BOWL REGION.																			
Fort Bend.....	880	9,380	4,940	4,434	1,871	7,509	10.7	38,379	6.8	28.3	10,873	6,431	0.59	855	295	12.4	7.3		
Wharton.....	1,070	4,549	2,285	2,264	917	3,632	4.3	22,735	3.3	24.5	5,563	3,182	0.57	855	285	5.2	2.0		
Brazoria.....	1,400	9,774	5,145	4,629	2,250	7,524	7.0	23,415	3.2	19.0	5,402	3,484	0.64	960	320	3.9	2.5		
Total.....	3,350	23,703	12,376	11,327	5,038	18,665	7.1	89,529	4.2	24.4	21,838	13,097	0.60	900	300	6.5	3.9		
RIO GRANDE VALLEY.																			
Cameron.....	3,000	14,959	7,865	7,094	14,842	117	5.0	15,909	0.8	0.2	25	23	0.92	1,380	460	.....	.....
Hidalgo.....	2,350	4,347	2,272	2,075	4,233	114	1.8	2,843	0.2	0.3	24	9	0.33	570	190	.....	.....
Total.....	5,350	19,306	10,137	9,169	19,075	231	3.6	18,752	0.5	0.3	49	32	0.65	975	325	.....	.....

COTTON PRODUCTION IN TEXAS.

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION—Continued.

NON-COTTON-PRODUCING COUNTIES.

Counties.	Land area. Square miles.	POPULATION.					TILLED LAND. Acres.
		Total.	Male.	Female.	White.	Colored.	
Total	89, 370	63, 755	36, 914	26, 845	60, 376	3, 383	64, 080
Aransas	440	996	508	488	917	79	229
Concho	950	800	504	296	783	17	183
Crockett	9, 500	127	76	51	127	.....	148
Crosby	900	82	77	5	81	1	45
Dimmit	1, 000	665	390	275	640	16	584
Donley	900	160	136	24	159	1	214
Duval	1, 700	5, 732	3, 173	2, 559	5, 087	45	3, 958
Edwards	950	266	155	111	265	1	284
El Paso	8, 000	3, 845	1, 954	1, 891	3, 598	247	10, 587
Encinal	1, 700	1, 902	1, 123	779	1, 901	1	12
Fisher	900	136	94	42	135	1	35
Gray	900	56	50	6	55	1	50
Hardeman	1, 180	50	42	8	49	1	72
Haskell	900	48	43	5	46	2	55
Hemphill	900	149	95	54	146	3	305
Kimble	1, 300	1, 343	737	606	1, 335	8	1, 447
Kinney	1, 700	4, 487	2, 801	1, 686	4, 006	481	4, 231
Knox	900	77	55	22	74	3	120
La Salle	1, 500	789	507	282	775	14	555
Lipscomb	900	69	59	10	67	2	24
McMullen	1, 160	701	450	251	654	47	455
Maverick	1, 300	2, 967	1, 635	1, 282	2, 873	94	937
Menard	880	1, 239	809	430	1, 202	37	788
Nolan	900	640	371	269	635	5	856
Nueces	2, 800	7, 673	4, 328	3, 345	7, 044	629	5, 400
Pecos	11, 000	1, 807	1, 064	743	1, 680	127	4, 105
Presidio	12, 500	2, 373	1, 761	1, 112	2, 444	429	5, 607
Runnels*	990	930	600	330	967	13	.....
Starr	2, 500	3, 304	4, 639	3, 665	3, 033	211	1, 391
Taylor	900	1, 786	978	758	1, 728	8	2, 794
Tom Green	12, 300	3, 615	2, 342	1, 273	2, 966	649	1, 065
Webb	1, 500	5, 273	3, 015	2, 258	5, 089	184	1, 129
Willbarger	940	126	86	40	126	.....	976
Zapata	1, 290	3, 636	1, 997	1, 639	3, 620	16	3, 200
Zavalla	1, 290	410	210	200	400	10	12, 104

* Organized 1880.

POPULATION OF THE COUNTIES.

	Total.	Male.	Female.	White.	Colored.		Total.	Male.	Female.	White.	Colored.
Total	1, 915	1, 446	469	1, 840	75	Childress and Collingsworth	81	30	1	27	4
Andrews, Dawson, Gaines, Martin, Terry, and Yoakum ..	44	37	7	43	1	Cottle, Dickens, King, and Motley	116	92	24	115	1
Armstrong, Briscoe, Randall, and Swisher	50	42	8	49	1	Floyd, Garza, and Lynn	48	40	8	47	1
Bailey, Cockran, Hale, Hockley, Lamb, and Lubbock	25	25	.....	25	.....	Hall	36	29	7	35	1
Borden, Howard, and Mitchell	202	152	50	195	7	Scurry	102	73	29	94	8
Carson, Hutchinson, Moore, Potter, and Roberts	110	88	22	108	2	Hansford, Ochiltree, and Sherman	18	16	2	18	.....
Castro, Dallam, Deaf Smith, Hartley, Oldham, and Parmer.	425	279	146	424	1	Wheeler	512	383	129	477	35
						Kent and Stonewall	196	160	36	183	13

AREAS OF UNORGANIZED COUNTIES.

Counties.	Area.	Counties.	Area.	Counties.	Area.	Counties.	Area.	Counties.	Area.
Total	46, 400	Cockran	820	Hale	1, 100	Lubbock	900	Randall	900
Andrews	1, 500	Collingsworth	900	Hall	900	Lynn	900	Roberts	900
Armstrong	900	Cottle	* 1, 100	Hansford	910	Martin	900	Sherman	910
Bailey	1, 050	Dallam	1, 400	Hartley	1, 470	Mitchell	900	Scurry	900
Borden	900	Dawson	900	Hockley	900	Moore	900	Stonewall	900
Briscoe	900	Deaf Smith	1, 400	Howard	900	Motley	1, 140	Swisher	900
Carson	900	Dickens	900	Hutchinson	900	Ochiltree	900	Terry	900
Castro	900	Floyd	1, 100	Kent	900	Oldham	1, 470	Wheeler*	900
Childress	750	Garza	900	King	900	Parmer	850	Yoakum	820
				Lamb	1, 100	Potter	900		

* Organized 1879.

TABULATED RESULTS OF THE ENUMERATION.

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TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS.

COTTON-PRODUCING COUNTIES.

Counties.	COTTON.		INDIAN CORN.		OATS.		WHEAT.		SWEET POTATOES.	
	Acres.	Bales.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
Total for the State.....	2, 178, 485	805, 284	2, 468, 587	20, 065, 172	238, 010	4, 893, 359	373, 570	2, 567, 737	19, 580	1, 460, 979
OAK, HICKORY, AND PINE UPLANDS.										
Cass	34, 822	16, 181	34, 410	427, 683	3, 188	35, 150	363	1, 651	434	48, 041
Morris	10, 050	4, 880	11, 082	144, 914	1, 256	15, 706	275	1, 398	150	12, 524
Titus	9, 395	4, 923	11, 379	170, 550	1, 997	30, 045	372	1, 926	110	10, 660
Franklin	8, 680	4, 048	9, 804	144, 287	1, 519	26, 086	480	2, 466	52	4, 495
Hopkins	19, 242	8, 279	25, 573	318, 214	7, 074	157, 182	3, 804	20, 044	256	14, 756
Rains	4, 399	1, 915	5, 477	75, 055	1, 055	25, 881	553	4, 226	81	7, 609
Wood	15, 486	7, 381	18, 635	253, 079	2, 801	40, 729	2, 282	10, 644	168	13, 086
Camp	11, 473	5, 689	11, 360	153, 467	1, 544	22, 077	824	3, 861	76	8, 247
Marion	17, 192	7, 515	13, 554	137, 006	565	6, 582	13	30	169	15, 038
Upshur	10, 418	8, 023	20, 728	246, 117	2, 517	26, 067	1, 425	5, 838	294	26, 139
Gregg	13, 767	4, 590	13, 411	120, 819	827	7, 161	22	103	145	11, 611
Harrison	46, 014	17, 019	38, 808	278, 981	765	7, 542	18	147	588	47, 320
Panola	28, 480	10, 344	27, 452	192, 090	1, 825	18, 749	44	205	292	27, 764
Rusk	38, 326	11, 145	39, 744	367, 700	2, 965	30, 953	123	506	416	33, 386
Smith	45, 703	16, 285	43, 631	515, 515	4, 633	64, 005	589	2, 929	287	25, 825
Van Zandt	17, 579	6, 957	21, 635	302, 427	4, 034	76, 744	1, 506	8, 231	187	14, 496
Henderson	15, 763	6, 159	18, 607	254, 828	2, 490	38, 997	179	959	105	12, 059
Navarro	45, 710	12, 958	40, 133	521, 462	4, 288	121, 548	2, 372	25, 160	96	6, 125
Limestone	35, 519	9, 037	32, 988	336, 620	2, 497	60, 033	1, 269	12, 887	156	12, 974
Freestone	31, 372	8, 182	29, 242	252, 742	1, 462	32, 623	151	1, 247	290	14, 632
Anderson	23, 725	7, 548	29, 852	306, 722	2, 780	33, 810	17	119	229	15, 172
Cherokee	29, 708	9, 813	37, 244	450, 573	4, 312	54, 463	210	1, 358	296	21, 894
Nacogdoches	16, 762	4, 791	25, 102	218, 205	886	9, 600	.....	.....	294	21, 988
Shelby	16, 136	6, 171	20, 985	185, 484	1, 200	12, 350	201	849	310	32, 489
Sabine	5, 252	1, 705	8, 322	66, 363	295	2, 613	.....	.....	183	13, 334
San Augustine	7, 219	2, 757	11, 442	80, 422	561	7, 327	.....	.....	172	15, 624
Angelina	5, 681	2, 319	8, 937	77, 056	156	1, 567	.....	.....	199	19, 083
Trinity	6, 802	2, 666	9, 184	96, 584	159	1, 671	.....	.....	89	7, 041
Polk	7, 220	3, 629	10, 997	121, 355	298	3, 826	.....	.....	101	10, 465
Houston	26, 819	9, 730	28, 066	283, 402	617	9, 847	29	281	178	13, 499
Leon	23, 578	7, 360	25, 490	223, 535	725	9, 896	.....	.....	167	9, 021
Robertson	49, 854	18, 080	34, 255	422, 889	1, 407	36, 873	67	560	147	10, 678
Madison	9, 158	2, 650	9, 694	74, 350	322	4, 803	.....	.....	43	2, 932
Walker	20, 162	6, 441	17, 512	153, 726	357	6, 645	15	125	245	11, 089
Grimes	35, 984	11, 701	29, 072	286, 969	555	10, 011	70	615	159	7, 433
Brazos	28, 044	9, 743	16, 542	165, 100	626	14, 435	8	25	130	7, 498
Burleson	15, 298	5, 965	14, 692	171, 552	320	7, 549	118	567	59	3, 622
Milam	37, 478	10, 844	32, 725	286, 792	1, 946	50, 168	593	3, 241	123	6, 163
Lee	15, 682	5, 526	14, 390	146, 271	745	16, 432	136	735	60	4, 324
Bastrop	35, 730	14, 714	31, 786	401, 099	1, 345	33, 704	852	4, 869	158	11, 543
Gonzales	22, 720	7, 511	30, 984	227, 501	767	12, 811	646	4, 489	60	4, 572
Wilson	5, 814	1, 874	7, 999	57, 467	43	320	96	355	69	4, 053
Total	914, 305	325, 654	923, 860	9, 828, 079	70, 654	1, 184, 947	20, 231	122, 646	7, 892	620, 625
LONG-LEAF PINE REGION.										
Newton	3, 510	1, 332	7, 503	69, 842	513	4, 946	.....	.....	318	36, 159
Jasper	4, 455	1, 410	9, 763	97, 366	1, 097	10, 134	.....	.....	362	31, 765
Orange	66	22	1, 237	10, 919	.....	.....	.....	.....	118	8, 921
Hardin	264	103	2, 491	21, 689	194	1, 525	.....	.....	138	15, 155
Tyler	5, 694	2, 543	11, 055	123, 887	1, 343	11, 748	5	25	358	31, 937
Liberty	3, 768	1, 852	6, 102	91, 098	40	215	.....	.....	168	13, 781
Total	17, 567	7, 262	38, 156	424, 701	3, 187	28, 568	5	25	1, 457	137, 738
SOUTHERN AND COAST PRAIRIE REGION.										
Region east of the Brazos river.										
San Jacinto	9, 840	5, 354	9, 494	102, 853	163	2, 127	.....	.....	86	5, 127
Montgomery	13, 311	4, 092	13, 702	115, 017	88	800	.....	.....	171	17, 749
Waller	10, 104	3, 923	10, 350	132, 691	126	2, 185	.....	.....	213	14, 560
Harris	4, 440	1, 892	9, 695	139, 833	172	7, 165	.....	.....	905	67, 832
Galveston	289	136	655	16, 367	44	1, 115	.....	.....	253	10, 302
Chambers	140	91	1, 839	30, 214	.....	.....	.....	.....	289	37, 854
Jefferson	133	77	1, 758	24, 169	.....	.....	.....	.....	121	10, 914
Total	38, 257	15, 565	47, 093	560, 644	593	13, 392	.....	.....	2, 038	160, 868

COTTON PRODUCTION IN TEXAS.

TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS—Continued.

COTTON-PRODUCING COUNTIES—Continued.

Counties.	COTTON.		INDIAN CORN.		OATS.		WHEAT.		SWEET POTATOES.	
	Acres.	Bales.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
SOUTHERN AND COAST PRAIRIE REGION—cont'd.										
<i>Region west of the Brazos river.</i>										
Washington	58,705	20,692	43,010	571,063	776	22,727	49	234	244	9,029
Austin	31,321	13,185	20,810	448,481	519	13,534	23	161	310	19,274
Fayette	58,353	24,766	47,770	694,883	1,023	28,045	205	1,432	414	20,706
Colorado	32,994	15,552	29,711	532,480	227	5,446			174	16,360
Lavaca	25,728	9,970	28,474	377,914	789	14,810	94	704	315	27,398
De Witt	7,625	2,183	19,148	135,016	639	6,185	500	1,842	151	6,835
Victoria	1,739	780	6,253	90,210	174	3,418	28	260	141	6,791
Jackson	648	202	3,787	37,175	45	380			144	7,046
Matagorda	3,435	2,090	4,747	74,563	14	580			197	17,722
Calhoun			266	2,072					15	917
Karnes	1,607	283	5,184	13,115	48	507	52	153	8	230
Atascosa	1,422	469	4,475	20,992	93	840			82	6,494
Frio	543	150	1,574	7,443			8	40	27	1,578
Live Oak	10	4	456	2,120					12	423
Bee	44	9	2,960	18,192					23	1,036
Goliad	1,779	728	9,059	87,305	273	2,696	372	1,284	94	4,216
Refugio	86	15	2,238	27,375					15	991
San Patricio	0	2	1,219	4,358	14	70			11	265
Total	226,001	91,048	237,747	3,145,303	4,634	99,844	1,801	6,110	2,377	147,325
CENTRAL BLACK PRAIRIE REGION.										
Cooke	27,795	11,547	32,353	514,420	4,388	73,596	7,960	62,306	94	6,107
Montague	10,947	4,172	15,571	195,584	1,018	13,206	2,101	14,958	100	1,404
Wise	21,352	7,231	27,400	357,404	2,267	43,963	4,121	26,749	101	3,850
Denton	29,785	11,568	35,326	531,637	6,233	112,681	12,103	72,412	230	13,935
Collin	43,236	22,145	52,256	1,016,140	10,834	333,419	24,242	188,702	277	17,451
Hunt	25,906	10,805	29,157	365,004	6,314	164,517	7,935	48,583	170	10,301
Delta	8,940	4,911	9,199	130,061	1,902	39,349	1,409	7,073	51	4,147
Kaufman	26,059	10,608	24,386	354,781	4,522	115,215	8,921	70,701	162	12,039
Rockwall	5,786	2,630	6,715	88,713	961	26,305	2,516	20,966	3	235
Dallas	44,377	21,469	44,004	575,667	8,306	209,281	20,854	180,400	295	17,724
Tarrant	27,821	10,950	33,490	429,118	7,055	153,071	26,481	103,073	181	3,083
Parker	15,036	4,454	24,987	243,245	2,253	30,561	12,306	81,033	86	5,336
Hood	7,139	1,966	10,427	72,027	605	12,607	4,855	21,519	15	404
Erath	14,220	2,857	19,702	103,883	1,822	22,660	5,832	23,397	40	1,406
Somervell	4,030	1,066	5,029	58,236	238	3,793	1,003	13,356	11	533
Johnson	40,446	13,778	38,151	413,940	5,528	134,566	14,339	95,299	90	6,964
Ellis	52,172	18,956	42,899	577,121	5,533	158,527	18,500	170,215	80	4,528
Hill	38,535	8,369	33,013	327,484	4,475	143,144	6,533	51,743	18	1,000
Bosque	10,624	3,833	22,491	202,846	2,273	53,939	9,503	74,704	30	1,779
Hamilton	6,840	1,147	12,941	73,052	723	12,569	3,772	24,154	15	461
Lampasas	4,611	628	9,153	49,402	760	10,747	3,033	17,800	25	2,174
Coryell	19,688	3,331	22,993	196,713	2,733	60,498	8,566	55,019	26	1,592
McLennan	53,394	12,777	48,857	515,048	9,091	287,545	18,682	197,520	77	3,454
Falls	39,609	12,495	29,943	376,555	1,200	30,697	953	6,626	150	3,082
Bell	37,826	9,217	40,475	402,322	5,169	161,324	10,923	84,267	54	2,844
Williamson	18,528	4,217	25,225	202,711	8,634	193,490	7,901	56,095	82	3,909
Travis	29,500	9,271	30,882	264,675	4,779	102,106	4,048	24,633	148	9,772
Caldwell	18,906	7,609	18,393	190,648	1,364	23,838	2,500	11,098	130	7,947
Hays	9,868	3,441	10,749	99,090	2,223	39,251	2,789	16,090	40	2,506
Blanco	3,039	690	5,332	35,330	597	8,863	2,106	8,931	25	1,427
Gillespie	4,082	767	5,297	13,935	527	5,887	3,533	13,395	66	2,762
Kerr	469	72	1,348	6,456	185	1,106	1,134	2,728	25	2,730
Kendall	1,808	286	3,657	5,552	655	3,592	1,167	1,850	34	1,424
Comal	5,860	2,102	8,990	39,036	861	10,717	2,898	13,414	50	2,240
Guadalupe	16,409	6,531	23,501	191,399	2,260	33,216	4,483	21,124	102	4,813
Bexar	4,273	1,543	14,601	93,841	2,159	26,186	1,597	7,676	230	10,810
Medina	635	289	11,600	35,164	1,069	8,005	1,008	3,116	12	486
Bandera	223	52	3,641	13,505	259	3,764	1,200	3,252	14	833
Uvalde	141	53	1,845	10,224	91	983	407	987	7	735
Total	744,685	249,893	840,684	9,378,676	121,866	2,853,014	280,360	2,003,072	3,485	195,647

TABULATED RESULTS OF THE ENUMERATION

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TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS—Continued.

COTTON-PRODUCING COUNTIES—Continued.

Counties.	COTTON.		INDIAN CORN.		OATS.		WHEAT.		SWEET POTATOES.	
	Acres.	Bales.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
WESTERN RED-LOAM PRAIRIE REGION.										
Clay	3,289	1,155	8,778	92,766	1,843	11,359	2,282	15,351	70	5,009
Wichita	103	43	1,361	18,525	10	70	50	532	10	358
Baylor	326	83	1,308	13,407	45	377	112	567	2	180
Archer	104	43	404	4,095	33	510	59	371	7	240
Jack	4,751	1,444	10,990	115,761	230	5,117	1,866	10,880	81	4,447
Young	2,040	554	9,181	86,591	114	1,219	1,947	13,197	8	785
Throckmorton	51	10	887	8,197			605	3,944	3	250
Jones	81	19	409	4,110	54	1,103	91	800	1	35
Schackelford	23	5	699	3,916	18	290	228	1,457	5	75
Stephens	686	137	3,824	26,074	254	3,081	2,187	11,191	5	170
Palo Pinto	4,292	885	9,301	60,628	305	5,416	2,425	11,844	30	958
Eastland	3,264	742	5,867	25,479	39	1,123	1,941	7,069	1	25
Callahan	434	86	2,245	14,059	56	569	1,091	5,078	43	358
Coleman	796	243	4,333	19,855	90	1,480	1,568	11,038	2	95
Brown	4,254	998	12,408	65,194	516	8,457	7,814	38,743	26	1,200
Comanche	9,301	2,008	14,207	85,454	460	6,839	5,074	20,141	82	2,878
San Saba	2,819	400	8,281	41,070	675	9,053	3,148	13,751	40	2,755
McCulloch	145	54	1,005	6,825	108	705	463	2,131	5	760
Mason	262	64	3,093	8,933	69	1,014	958	4,492	12	483
Llano	2,247	469	7,700	60,200	209	2,805	1,145	4,209	5	382
Burnet	7,024	1,899	14,187	123,505	1,997	30,128	5,173	29,071	42	1,722
Total	46,301	10,931	120,468	885,553	6,675	100,355	40,227	215,826	480	23,005
RED RIVER ALLUVIAL COUNTIES.										
Bowie	11,599	7,958	13,199	194,782	600	6,336	7	20	136	14,813
Red River	31,291	17,669	32,898	634,490	2,970	52,453	1,044	7,678	150	11,414
Lamar	40,390	24,623	40,617	817,854	5,651	131,067	3,047	18,963	220	18,862
Fannin	44,813	22,386	48,124	922,738	9,698	205,880	7,753	54,504	188	12,253
Grayson	41,339	19,166	56,344	970,731	10,009	188,188	15,736	96,740	315	21,414
Total	169,432	91,802	191,182	3,546,595	28,928	584,824	27,587	177,905	1,015	78,762
BRAZOS ALLUVIAL OR "SUGAR-BOWL" REGION.										
Fort Bend	10,873	6,431	10,710	326,048	284	4,240			243	21,758
Wharton	5,563	3,182	9,477	245,717	5	50	5	25	59	6,225
Brazoria	5,402	3,484	13,044	234,950	348	5,335			400	43,884
Total	21,838	13,097	33,231	807,815	637	9,625	5	25	702	71,867
RIO GRANDE VALLEY.										
Cameron	25	23	9,526	137,695	25	125				
Hidalgo	24	9	2,117	42,465					8	430
Total	49	32	11,643	230,160	25	125			8	430

COTTON PRODUCTION IN TEXAS.

TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS—Continued.

NON-COTTON-PRODUCING COUNTIES.

Counties.	INDIAN CORN.		OATS.		WHEAT.		SWEET POTATOES.	
	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
Total	17,973	258,083	811	12,765	3,755	42,128	173	14,802
Aransas	104	890	9	100			11	890
Concho	40	300						
Dimmit	80	215					4	600
Donley	128	565						
Duval	456	1,117	25	250				
Edwards	102	605			14	34	2	150
El Paso	888	4,410	5	120	2,584	28,911		
Encinal	28	300						
Gray	46	500						
Kimble	152	1,155	10	110	5	80	10	2,082
Kinney	1,575	28,840	255	5,700			8	2,500
Knox	60	1,200						
La Salle	28	280						
McMullen			80	1,200				
Maverick	685	7,454						
Menard	72	690					13	2,370
Nolan	64	330						
Nueces	3,165	60,615	13	160			127	6,160
Pecos	2,533	16,872	7	125	20	120		
Presidio	3,818	35,450	203	1,850	1,025	11,423		
Starr	884	10,805						
Taylor	73	1,000			157	1,610		
Tom Green	468	7,085	108	1,900				
Webb	626	8,524						
Wilbarger	225	2,600					1	76
Zapata	2,135	68,940	15	600				
Zavalla	143	1,835	81	650				

PART I.

PHYSICO-GEOGRAPHICAL AND AGRICULTURAL FEATURES

OF THE

STATE OF TEXAS.

GENERAL DESCRIPTION OF THE STATE OF TEXAS.

Texas is the extreme southwestern state of the Union, the Rio Grande separating it from Mexico and the meridian of 103° forming the line between it and New Mexico. On the north the boundary is marked by the Red river from Louisiana to the meridian of 100° , thence northward of that meridian to its intersection with the parallel of $36^{\circ} 30'$ north latitude, and thence west to the meridian of 103° . There are two hundred and twenty-five counties in the state, seventy-two of which are still unorganized, and they vary in area from 150 to 12,000 square miles, the large counties lying in the uninhabited portion of the state on the west.

The entire area, as estimated by Mr. Henry Gannett, geographer of the Tenth Census, is 265,780 square miles, which includes 3,490 square miles of water area, comprising coast bays and gulfs, rivers, and lakes, leaving 262,290 square miles of land surface alone.

The area of Texas, therefore, comprises 8.7 per cent. of the entire area of the United States and territories (3,025,600 square miles), and, comparing it with other states, we find it to be nearly as large as the combined areas of Louisiana, Mississippi, Alabama, Georgia, and Florida, or of that of the New England and middle states, with Ohio and Illinois, all combined. In comparison with the countries of Europe, we find that Texas is larger than either the Austrian or the German empire, France, or the islands of Great Britain.

It is estimated by Mr. Gannett that of the entire area of the state 129,200 square miles comprise the inhabited portion, with a population of 1,591,749, giving an average of a little more than twelve persons per square mile. The remaining 133,090 square miles (land area) include the southwestern prairies and the plains and gypsum lands of the west and northwest.

Between the extreme east and west points of the state there are about 13 degrees of longitude, or a little more than 900 miles; from north to south there are included about 10.75 degrees of latitude, or nearly 750 miles.

TOPOGRAPHY AND GENERAL FEATURES.—In the state of Texas we find combined a great diversity in both soil and topography, the former passing from the extreme of fertility on the Red river on the north, the Brazos in the middle, and the Rio Grande on the extreme south, to the extreme of sterility in the sand desert of the south; in topography, from the extreme of low and flat prairie lands and a very little marsh along the coast, by gradual transitions and elevations, to the chains and peaks of mountains on the far west, whose summits are 5,000 feet or more above the sea.

To these extremes may be added that of population, for we find on the east and central (north and south) parts of the state comparatively thickly-settled counties and large and flourishing towns and cities, while on the west emigration and settlements have scarcely yet reached the foot of the plateau of the great plains.

To complete the picture of extremes, as it were, we find that several of the great agricultural regions that form so prominent a feature in the other southern states have their termini in Texas, and are cut off on the southwest either by the prairies of the coast or by the great mesquite and cactus chaparral prairies of the Rio Grande region, or they abut against the eastern bluffs of the plains.

The coast of Texas presents features different from those of any other state; for while in other states the mainland coast is greatly cut up into large bays, extending many miles inland, it is here bordered by an almost continuous chain of islands and peninsulas (the latter having the same trend as the islands). The Gulf border of this chain is a very regular line southwest from the mouth of the Sabine river or lake to near Corpus Christi, which occupies the highest point on the entire coast, and thence turns with a regular curve south and slightly southeast to Mexico. The islands and peninsulas, which are separated from the mainland by distances of from 10 to 20 miles, more or less, are covered with heavy belts of sand and sand dunes, rising 15 or 20 feet above the beach. The

latter skirt the shore-line for many miles, and, as on Galveston island, are usually broad, and offer many inducements to pleasure-seekers. The longest of these islands is Padre island, which extends from Corpus Christi bay to near the mouth of the Rio Grande, a distance of more than 100 miles. The large estuaries that have been formed at the mouths of the streams, except the Sabine, the Rio Grande, and those of the Brazos section, form another feature peculiar to the Texas coast. The border lands of these estuaries are usually high, their almost vertical clay bluffs being washed by the waters of the bay, and the open prairies of the uplands often extend to their very edge.

Mr. Gannett estimates the water area of the coast bays, gulfs, etc., to be 2,510 square miles, and that of the rivers and lesser streams at about 800 square miles.

A general view of the state, as presented in two cross-sections, presents the following features :

1. *Along the Louisiana line.*—From the mouth of Sabine river northward we find at first a small area of marsh lands, terminating the marsh region of Louisiana, and not occurring to any extent westward. Passing these, we come to the long-leaf pine flats, extending westward only to the Trinity river, and being also the western terminus of the belt that extends across all of the Gulf states, the lower part of Florida, and along the Atlantic coast through North Carolina. Its surface in Texas is quite level northward for about 50 miles, when the more undulating or rolling pine hills are reached, which also form a border to the pine flats just mentioned across the southern Gulf states. Thence northward to Red river the country is rolling and hilly, and is covered with oak, hickory, and short-leaf pine—a region that extends eastward through Louisiana, Arkansas, and the northern part of Mississippi into Tennessee. This region passes southwestward, becoming more and more narrow, until it tapers off to a point 100 miles from the Rio Grande, and also includes the belt of red Tertiary hills of the other states, that probably terminates on the southwest in Guadalupe county.

2. *From the coast in a northwest and west direction.*—The mainland coast of Texas presents a very irregular outline with its many bays, peninsulas, and islands, and but a small proportion of the mainland reaches the waters of the Gulf. As before stated, there is scarcely any marsh land on the coast west of the Sabine marshes.

For a distance of from 50 to 100 miles inland from the coast the country is very level, with open prairies, whose continuity is broken only by the timbered streams, with occasional strips or "motts" or clumps of timber, and by the broad and heavily timbered alluvial or "sugar-bowl" region of the Brazos.

The rise, slight and very gradual inland from the coast, is almost imperceptible for many miles, when the country becomes undulating and then rolling, and the prairies give way to the more or less broken and hilly oak and pine uplands, which cover all of the northeastern part of the state, as already mentioned. The country rises rapidly to the north and northwest, reaching an elevation of several hundred feet along the western edge of the timbered region, and is interspersed throughout with small "brown-loam prairies". Leaving the timber lands, and continuing northwest, we find a region of "black waxy prairies", underlaid by the Cretaceous "rotten limestone", extending southwest to San Antonio, and thence west to the foot of the plains. Northward this region passes through the southern part of the Indian territory into Arkansas. These prairies are at first, on the east, rather level, or at most undulating, with an altitude of 500 or 600 feet, but westward become more rolling, hilly, and broken, until finally, on their western limits, high and bald hills and peaks stand out in bold relief at an elevation of nearly 1,000 feet above the sea. The monotony of these interior prairies is broken by the timbered streams and on the north by the wide belt of "lower cross timbers", which reaches from the Red river to the Brazos in an almost due south course. Otherwise there is very little timber to be seen.

At the western edge of the northern half of the black prairie region there is another belt of "cross timbers", interspersed with small black Cretaceous prairies, very irregular in outline and in width, and beyond it is the broad red-loam and partly timbered region, comprising high ridges, mesquite prairie valleys, and broad table-lands, the country gradually rising to the foot of the high plateau of the Llano Estacado, several thousand feet above the level of the sea. This region terminates on the southwest against the bluffs of the plains south of the Llano Estacado, and a large area penetrates southeastwardly almost across the black prairie region.

On the northwest there is a large, extensive region, lying wedge-shaped, with its point south, between the red-loam lands and the Llano Estacado, and comprising the great gypsum lands of the state, with high and rolling prairies, whose uplands are largely destitute of timber.

To the westward the broad, level, and bare plains of the Llano Estacado occupy a terrace with abrupt bluffs on the north some 200 feet above these regions, and with a gentle rise pass out of the state into New Mexico on the west and to the mountains on the southwest. Deep cañons have been cut into the eastern part of this plateau by the headwaters of the large rivers of the state, but to the west there is only a vast, treeless plain, more or less undulating, with a few low but prominent sand hills and ridges.

On the extreme west, between the Pecos and the Rio Grande, the country reaches its maximum height, with several chains of almost treeless mountains rising several thousand feet above the general level, and separated from each other by broad and level plains 20 or 30 miles in width and almost destitute of vegetation. These mountain ranges enter the state from New Mexico. Southward the plains extend along the Rio Grande to a point a little south of its junction with the Pecos. Thence to the Gulf are broad and high prairies, broken by deep arroyos or ravines, and with little growth other than occasional live-oak trees and great chaparrals or thickets of thorny shrubs.

TIMBER GROWTH.—The upland timber growth most general throughout the state is post and black-jack oaks. These occur on all of the sandy timbered lands that cover so large a region on the east from Red river southward and southwestward to the Nueces river, are the chief growth of the upper and lower cross timbers, and are found on the hills of the eastern part of the northwestern red-loam region and on the borders of the bottom lands of the streams of the central black prairie region. They are associated more or less throughout the state with scarlet, black, white, and other oaks and hickory, and in eastern Texas with short-leaf pine, dogwood, persimmon, sassafras, etc.

The short-leaf pine is most prominent in the extreme northeastern and southern parts of the eastern timbered region, while the long-leaf species is found only on the southeast between Trinity and Sabine rivers, being the almost exclusive growth over a large part of the region, which covers an area of about 5,312 square miles.

Live oak is a prominent tree in the coast region, appearing in motts or clumps on its prairies, in the valleys of the Brazos, the Colorado, and other rivers, and in the counties bordering the great plains. The widely extending branches of the tree are on the south usually festooned with long moss (*Tillandsia usneoides*), and the tree affords a pleasant retreat on the prairies during the heat of a summer day.

The mesquite (*Prosopis juliflora*) may be considered a prairie growth, though having usually the size of a small tree, and is not found, so far as I am aware, east of the ninety-fifth meridian. It occurs at first on the east rather sparsely in motts in low places on the prairies, but westward it is more and more abundant, and on the southwest, to the Rio Grande and to the foot of the Llano Estacado, it becomes almost the exclusive upland growth, and with the "wesatche" (probably a variety) and the cactus forms the great chaparrals of the west. On the plains its buried stocks or roots afford almost the only fuel; nothing but a twig of the stock appears above ground, its growth no doubt being prevented by the severe winds that sweep over the plains, the dwarfed cedars of the bluffs only remaining, because protected.

BOTTOM GROWTH.—Elm, hackberry, and pecan occur more generally than any other trees throughout the bottom lands of the state, and on the large rivers in the timbered region they are associated with walnut, ash, several varieties of oaks, hickory, sweet and black gums, wild peach, etc., and on the extreme east with some cypress and magnolia (*M. grandiflora*). The latter growth is not reported west of the pine region. The bottom lands of the region are heavily timbered, but on the west of the central black prairie region the usual varieties of growth disappear, and elm, cottonwood, hackberry, mesquite, and some pecan are found along the banks of the streams to their headwaters at the foot of the Llano Estacado. The Pecos and the Rio Grande north of Hidalgo have little or no timber growth.

CLIMATE.—Temperature.—The large territory occupied by the state naturally presents a variety of climate, and we find from the reports of the United States signal stations for 1880 (a statement of which has been furnished me from the chief office at Washington) that while the coast counties are warmed by the sea breezes during the winter months and have a mean temperature of 53° in December, the northern counties along Red river suffer severer weather, the temperature of Denison for the same month being 41°. The minimum and maximum extremes during December were at Galveston 18° and 72°, and at Denison 2° and 76°. At Corsicana, an intermediate point, the extremes were 6° and 80°, with a mean of 47.4°. Brownsville, situated more than three degrees south of Galveston, has for the same month the same minimum (18°) and a higher maximum (83°).

During the summer months the northern counties of the settled portion of the state enjoy cooler nights and hotter days than those of the coast, though the mean temperature was the highest on the coast by several degrees. July at Galveston, and August at Denison, were the hottest months, the average temperatures being respectively 83° and 80°, with maximums of 93° and 101°.

Eagle Pass, on the Rio Grande, seems to be the hottest place in the state, its maximums for the months from the first of March to the last of July being greater than was recorded at any other point during the same time, and that for the months of June and July, 108°, being also the highest in the state for the year.

At Rio Grande City a maximum temperature of 105° was recorded in April and June, and at Fort Stockton, in Pecos county, 106° in June. At Brownsville and San Antonio the highest temperature, 95° and 98° respectively, was reached in July.

Fort Elliott, in the northwestern part, or Panhandle, of the state, enjoys the coolest summers, the thermometer for the three months not rising above 86.7°.

One of the most prominent features of Texas climate is what is commonly termed "the Texas norther", a sudden and extreme change of temperature produced by a rush of cold wind from the north, usually coming unannounced, though sometimes indicated by a haziness in the northern sky. The northers are usually preceded by a warm spell of twenty-four hours, more or less, and the change of temperature is very great, sometimes in the winter months falling as much as 30° or 40°, though usually much less. They continue about three days, the second being the coldest, and are succeeded by warm weather, though sometimes the northers follow each other so closely as to produce eight or ten days of cold. They may be expected at all times of the year, and it is customary for travelers to be provided with blankets even for a trip of a few days. These northers are sometimes accompanied by rain, and are classed as *dry* or *wet* northers. The summer northers are not as frequent as the winter ones nor as marked, sometimes being oppressively close and warm, instead of cold.

Thunder-storms occur during the year throughout the state, and severe winds and tornadoes sometimes sweep over sections of the country. The latter are, however, of far less frequency than in the northwestern states.

Rainfall and water supply.—The winds that bring rain and thunder-storms usually come from the southwest, those from the north being mostly dry. From the records of the United States signal office it seems that during 1880 the greatest amount of rain fell at Galveston, amounting to 50.1 inches, and at Denison 46.3 inches, while at Corsicana, San Antonio, Fredericksburg, and Brackettsville, lying in a northeast and southwest course from each other, the precipitation was over 40 inches. The least amount of rainfall (from 16 to 24 inches) was reported from Fort Elliott, in the Panhandle, Fort Davis, west of the Pecos river, and Rio Grande City, in Webb county, on the southwest, while at several other points on the west and along the Rio Grande it was less than 30 inches.

With regard to the seasons, it seems that the winter months are the driest of the year very generally throughout the state, the precipitation varying from 3 to 7 inches, and much less in Denton county and several points on the west and southwest. During the spring months the rainfall was greatest in the eastern counties, amounting to from 12 to 13 inches. At all other points, except San Antonio, Mason, Fredericksburg, and Fort Griffin, less than 9 inches was obtained, the country west of the Pecos river being very dry.

During the summer months the country around Corsicana suffered greatest from droughts, while Denison, San Antonio, and other places over the west and southwest enjoyed their greatest rainfall for the year, the maximum for any one month in the year throughout the state (21 inches) having been reached at Brownsville in August.

The fall months vary but little from those of summer, except that there is more rain in the eastern counties. From the reports given, San Antonio seems to enjoy the greatest regularity in its monthly rainfalls, there being but one month when it was less than 2 inches, while its maximum for any month of the year was 8.6 inches. The record of Corsicana shows very nearly the same regularity, a maximum of 7.7 inches.

The country west and southwest of the black prairie region is visited by rains, chiefly between the first of May and the last of September. These rains come suddenly, and, while lasting but a few hours, are drenching in character, flooding the country, and hence probably producing the great ravines or *arroyos* that form a prominent feature of the southwest. The water soon disappears; the small streams are dry throughout the greater part of the year, and dependence is put chiefly upon the larger ones that have their sources from springs at the foot of the great plains. In the red-loam region, on the north, parties have sometimes been successful in digging wells that afford a supply of water for a portion of the summer; and when near a village or town such wells, or even streams of water, are a source of revenue to the owners. Attention is now being turned to the sinking of artesian wells, but I know not with what success their efforts have been met.

In the black prairie region, occupying the central portion of the state, the various small streams usually become dry during the summer, and some trouble is experienced in obtaining a sufficient supply for general purposes. Wells cannot be relied upon, and their water is so strongly saturated with lime from the rotten limestone rock (Cretaceous) as to be almost unfit for domestic uses, thus compelling families either to build cisterns or to haul water in casks and barrels from some neighboring stream, sometimes several miles distant. In the large cities water is furnished from artesian wells 700 feet or more in depth, the supply coming from beneath the rotten limestone formation.

The timbered region of eastern Texas is better supplied with water than any other part of the state. Springs of good freestone water are found in almost every county, and wells furnish an abundant supply for domestic purposes. The small streams usually become dry during the summer months, and artificial reservoirs, or simple earth embankments, collect a sufficient amount of water during the rainy seasons for farm and stock purposes.

RIVER SYSTEMS AND DRAINAGE.—Since the entire country is little else than a vast plain, gradually rising from the coast to the northwest, the drainage is naturally southeast to the Gulf, and the many rivers of the state cut their way in almost parallel courses to the coast. The Red, Brazos, and Colorado rivers all have their sources at the foot of the eastern bluffs of the Llano Estacado, whence they flow eastward through the red-clay lands to the black prairies, and, with the exception of the first, then turn southeast to the Gulf.

Red river maintains its eastern course along the entire northern border of the state, and turns south only after it enters the state of Arkansas. It drains an area of about 29,000 square miles in Texas alone. From the red clays these streams of the northwest derive that red color which characterizes their waters throughout their course, and which has given Red and Colorado rivers their names. The waters of Canadian river, on the northwest, are similar in character, and to this is due the mistakes of the earlier military surveying parties in their location of the sources of the Red river.

The waters of the Brazos and Red rivers, passing as they do through the gypsum beds of the northwest, have dissolved much of that mineral, and for many miles after leaving the beds are salty and disagreeable to the taste and scarcely fit for use. Captain Marcy found that this was due entirely to this gypsum formation, and that the sources of the streams, when westward of that region, comprised springs of pure and excellent water.

The streams, in their passage through the soft materials that enter into the formations of the western region, have cut their way to great depths, forming great narrow and steep cañons, with gradually widening valleys to the eastward. Quicksands characterize the river beds, and during seasons when the waters are low and the sand banks become dry great sand clouds are raised by the winds and borne here and there. The banks of Red river are high, and the stream is navigable for a great distance during high water.

Sabine river has its source in northeastern Texas, and forms the eastern boundary of the state from the thirty-second parallel of latitude to the Gulf. It is navigable during high water for a distance of 300 miles from its mouth. The Texas side of the basin, drained by the Sabine and its tributaries, comprises about 17,100 square miles.

Trinity river rises a short distance west of the central black prairie region, and has a general southeast course to the Gulf. It is not very wide, and the water has a great depth in wet seasons. It is a very crooked stream, but boats have ascended from its mouth to Dallas, a distance of 900 miles. It drains, with its tributaries, about 16,600 square miles.

Brazos river drains a larger territory than any other stream, about 35,000 square miles, and it is looked upon as the most important river of the state. Its basin is very wide on the northwest, comprising various forks and tributaries, viz, Elm, Double Mountain, Salt forks, and Leona rivers. Below the mouth of the latter the river basin becomes very narrow, the level lands of the "sugar-bowl" allowing the small streams that lie within three or four miles of the river to find their way independently to the Gulf. Boats are said to have ascended the river to the falls near Marlin, in Falls county, a distance of 600 miles.

The *Colorado river* rises at the south of the gypsum formation, and its waters escape its influence. It is bordered in many places by high bluffs, but much of its bottom land is subject to overflow during high water. It is said to be closed to navigation by a sand-bar at its mouth and a raft in its channel. Its basin comprises about 24,700 square miles.

The *San Antonio* and *Guadalupe* rivers, formed by the union of other streams, are not as long as the other rivers described, but drain a territory of about 10,000 square miles.

The *Nueces* rises near the northern border of the plains, and has a very irregular course, flowing for a long distance in a northeasterly course. It is joined by the Frio and the Leona, and with them drains a territory of about 15,300 square miles.

The *Rio Grande* finds its way to the Gulf from the mountains of the northwest through cañons and high banks, and is only navigable to Camargo, about 500 miles from the Gulf. Its tributaries on the Texas side are mostly short, and its drainage system south of the Pecos covers but about 9,300 square miles. Quicksands form a prominent feature of the river bed.

The *Pecos river* is described as being a narrow stream of muddy water flowing rapidly between high and vertical banks, on which there is little or no vegetation to mark its course.

GEOLOGY.—The geological features of the state are as yet but comparatively little known, the state surveys that have been inaugurated having been in existence but a short time before support was withdrawn by the legislature and when the results of the work were but partially published. In view of this fact, and covering, as the state does, such a vast territory, it has been thought best to give a rather full description of its more general geological features, as gathered from available sources and personal observation.

Azoic.—The Azoic series of rocks, represented chiefly by granites, is found most generally in two regions, viz, in the mountainous region west of the Rio Pecos, and in the counties of Gillespie, Llano, Burnet, and San Saba, in the central part of the state. So far as known, they do not occur in broad areas, as in some of the other states, but in rather isolated spots, surrounded by or associated with later Palæozoic and Mesozoic formations.

On the west of the Pecos the several chains of mountains (Guadalupe, Sacramento, and Organ) that rise several thousand feet above the intermediate and level plains are largely granitic, with accompanying sandstones and limestones. In some of the mountains characteristic eruptive rocks are reported as penetrating the later formations and rising above them in huge masses, or forming vertical columns, as in the Organ range, near El Paso.

The *easterly granitic region* lies south of San Saba river, its southern limit being 17 miles north of Fredericksburg, in Gillespie county. Its eastern limit follows the Colorado river, and its western extends into Mason county. The rocks are mostly of the pink feldspathic variety, resist disintegration, and form high and prominent points or hills throughout the region. One of these hills, the Enchanted Rock, 18 miles north of Fredericksburg, is thus described in Thrall's *History*:

It is a huge granite and iron formation, about 800 feet high, covering at its base several acres of space, its top being about 400 yards square. Its name is derived from its magnificent appearance, for when the sun shines upon it in the morning and at evening it resembles a huge mass of burnished gold.

These hills are surrounded on all sides by a comparatively level country, and their rocks are overlaid by later formations.

Northward from the outcrops of Llano county granite has not been observed in Texas, but it occurs extensively in the Wichita mountains north of Red river, and I found it in a recent trip at Tishomingo and Boggy Depot, Indian territory, near the line of the Choctaw and the Chickasaw nations, where it was massive in form and consisted largely of pink feldspar, and was penetrated by seams of bluish trap-rock.

These granites seem to be a part of an eruptive dike that passes through the state from the Santa Rosa mountains, in Mexico, northeastward into the Chickasaw nation, and terminate in the eruptive rocks of Missouri and

Arkansas. (a) In the region of these mountains in Mexico are the cones of extinct volcanoes, while the associated limestones are highly metalliferous, with disturbed and even vertical strata. The face of the country from the mountain to the mouth of Elm creek, on the Rio Grande, is said to be "broken, while the flat, long stretching ranges of hills are frequently overthrown".

On the Texan side, the first marks of volcanic action are to be seen at the head of Leona river. Here a solitary hill of 60 or 70 feet in height occurs, formed entirely of dark green basalt, which is closely allied to that of the Santa Rosa mountains, containing much hornblende and olivine. In the vicinity of Fort Inge, and also near the head of Las Moras, are several hills of the same nature. The road from Leona to the first crossing of Devil's river leads over several places indicating volcanic action. The west bank of the Rio Frio at the crossing is formed of a solid mass of basaltic rock, which undoubtedly belongs to the dike alluded to as having its origin in the Santa Rosa mountains, and here crossing the Cretaceous formation. (b)

Palæozoic.—The formations referred to this age enter the state from the north and extend south through the Azoic region, in Gillespie county. They are bordered by the Cretaceous formation on the east, the line marking the limit passing from Montague county southward to a point 15 miles west of Weatherford, in Parker county, thence through Erath and Comanche to the western part of Lampasas county at Senterfitt, and into Burnet county, where they become associated with the Azoic rocks. The western limit of the region is as yet indefinitely known, though probably marked by the eastern boundary of the gypsum formation, extending from near the mouth of the Big Wichita river southwest to the headwaters of the Colorado.

It has not been ascertained to what extent the different formations of the Palæozoic are represented in the state; but Silurian sandstones and limestones are reported in Llano, Burnet, and San Saba counties, while the northern and greater part of the region seems to be Carboniferous. Beds of coal (probably of the Upper Coal Measures), varying from a few inches to several feet in thickness, occur in Stephens, Young, and several other counties, while conglomerates, sandstones, and limestones, accompanied by Carboniferous fossils, are found in abundance. The hills are usually capped by a reddish sandstone (probably Permian) several feet thick, and its materials, which are devoid of fossils, vary from fine to coarse sand, and are accompanied sometimes by fragments of iron ore.

Palæozoic rocks are reported in the mountains west of the Pecos river, and include representatives of each of the formations except Devonian (which has not been recognized in Texas), sometimes with uptilted strata, resting upon granites and surrounded in the valleys by horizontal Cretaceous beds. The Permian rocks are extensively developed in the Guadalupe range (according to Dr. Shumard), (c) and so far as known this is the only occurrence of this formation in Texas.

Triassic and Jurassic.—The extensive gypsum and red-clay beds of the northwest have been referred to these formations by some geologists. They extend westward to the foot of the great plains, and consist of alternating strata of red clays and gypsum, overlaid sometimes by sandstone and conglomerate. Dr. Shumard observed them underlying the bluffs of the Llano Estacado, a Cretaceous formation.

Cretaceous.—The most prominent geological as well as agricultural division of the state is the Cretaceous, its broad area of white rotten limestones and black waxy prairie lands occupying a central position in the state east and south of the region just mentioned, and extending westward to El Paso, including the great plains. The most eastern exposure of the rocks of the formation which I observed was at a point not far below the mouth of Kiamitia creek, which enters Red river from the Indian territory. Cretaceous fossils, (among them *Ostrea quadriplicata*) are here found in a bluish calcareous marl and sandstone several feet in thickness, overlying a softer sandstone, which in the river beds has been worn into a variety of fantastic forms. To the southward the Cretaceous beds are covered by the sands and clays of the Tertiary uplands, which extend from the east to within three miles of Clarksville, where are found the first outcrops of rotten limestone—a soft, chalky rock, white for the first few feet from the surface, but bluish below. It is the rock so extensively developed all over this central black prairie region, and which is in localities so rich in huge ammonites, gryphæa, and other fossils.

The line marking the eastern limit of the formation passes from Clarksville, Red River county, southwestward to Terrell, where in the railroad cut I observed an outcrop of a hard fossiliferous limestone, resembling in character that of the Ripley group of Mississippi, and with blackened fossil fragments as in the Cretaceous beds north of Lumpkin, in Stewart county, Georgia. Among the fossils recognized were *Turritella*, *Exogyra*, *Belemnites*, and *Cardium Ripleyensis*. Farther southward the most easterly Cretaceous outcrops are four miles west of Corsicana, in Navarro county, a few miles east and south of Marlin, in Falls county, at Cameron, in Milam county, a mile or two west of Elgin or near the western line of Bastrop county, at Seguin, in Guadalupe, and thence the line passes through the northwest corner of Atascosa, and westward south of the mouth of the Pecos river, on the Rio Grande.

The territory occupied by the Cretaceous formation is very large, comprising the broad eastern and southern region whose limits have just been given and the great plains of the Llano Estacado, and extending far beyond to

a The line of outcrop, in its nearly westward course from Little Rock, Arkansas, through the Indian territory, to the Wichita mountains, thence southward to Gillespie county, and again southwestward into Mexico, coincides with the strikes of the metamorphic strata of eastern Georgia, as well as with the trendings of the chain of metamorphic mountains that borders the same region on the northwest (the Salacoa, Pine Log, Dug Down, *et al.*). (See report on Georgia, page 12, this series.)

b Mexican Boundary Survey, vol. I.

c Trans. Acad. Sci. of Saint Louis, vol. I.

the northwest. The rocks of the eastern prong of this formation, or "the central prairie region", as it has been agriculturally termed, have been estimated by Dr. Shumard to have a thickness of about 1,500 feet, with the following subdivisions and characteristics, as given by him in the *Trans. Acad. Sci. of Saint Louis*, vol. I, part 4:

Section of Cretaceous strata in Texas.

Divisions.	Subdivisions.	Feet.	Characteristic fossils.
UPPER CRETACEOUS OR CALCAREOUS.	Caprina limestone.....	60	
	Comanche Peak group.....	800 to 400	<i>Exogyra Texana</i> , <i>Gryphæa Pitcheri</i> , <i>Janira occidentalis</i> , <i>Cardium multistriatum</i> , <i>Lima Wacoensis</i> , <i>Ammonites Pedernalis</i> , <i>Natica Pedernalis</i> , <i>Heteraster Texanus</i> , <i>Holcotypus planatus</i> , <i>Cyphosoma Texana</i> , and <i>Diadema Texana</i> .
	Austin limestone.....	100 to 200	<i>Gryphæa vesicularis</i> , <i>Exogyra costata</i> , <i>Radiolites Austinensis</i> , <i>Nautilus Dekayi</i> , <i>Baculites anceps</i> .
	Fish-bed.....		Fish remains— <i>Mosasaurus</i> .
	Indurated blue marl.....	60	<i>Exogyra arietina</i> , <i>Dentalia</i> .
	Washita limestone.....	100 to 120	<i>Gryphæa pitcheri</i> , var. <i>Treomcarri</i> , <i>Ostrea subovata</i> (<i>O. Marshii</i> Marc.), <i>O. carinata</i> , <i>Inoceramus problematicus</i> , <i>Hamites Fromenti</i> .
	Blue marl.....	50	<i>Inoceramus problematicus</i> , <i>Ostrea</i> , etc.
LOWER CRETACEOUS.	Caprotina limestone.....	55	<i>Orbitolina Texana</i> , <i>Caprotina Texana</i> , <i>Natica acutispira</i> .
	Arenaceous group.....	80	<i>Ostrea bellarugosa</i> . <i>Cyprina</i> (?). Fish remains.
	Fish-bed.....		
	Marly clay or Red river group.....	150	<i>Ammonites Swallowii</i> , <i>A. Meekianus</i> , <i>Ancylloceras annulatus</i> , <i>Scaphites vermiculus</i> , <i>Baculites gracilis</i> , <i>Gervillia gregaria</i> , <i>Inoceramus capulus</i> , fossil wood.

I.—UPPER CRETACEOUS OR CALCAREOUS REGION.

This division, in the eastern or settled portion of the state, attains a thickness of from 800 to 1,000 feet, but in its western extension reaches a much greater development. It presents the following subdivisions, from above downward: *Caprina limestone*, *Comanche Peak group*, *Austin limestone*, *Exogyra arietina marls*, *Washita limestone*, *Inoceramus problematicus beds*, and *Caprotina limestone*.

CAPRINA LIMESTONE (thickness, 60 feet).—This is the uppermost recognized member of the series, and, although of no great thickness, has a somewhat extended geographical range. It is a yellowish-white limestone, sometimes of a finely granular texture, and sometimes made up of rather coarse, subcrystalline grains, cemented with a chalky paste. It generally occurs in thick, massive beds, and is capable of withstanding the action of the weather to a greater extent than most of the members of the Cretaceous system.

This formation is usually found capping the highest elevations, and its presence may be nearly always recognized, even at a distance, by the peculiar flat-topped and castellated appearance it imparts to the hills.

According to Dr. Riddell, it is finely displayed along the bluffs of Brazos river, in Bosque, McLennan, and Hill counties; also along the Leen and Bosque rivers. The summits of the remarkable elevation known as Comanche peak, in Johnson county, and that of Shovel mountain, in Burnet county, consist of this rock. The fossils are chiefly *caprina*, *cytherea*, and *ammonites* of undetermined species.

COMANCHE PEAK GROUP (thickness, from 300 to 400 feet).—The Comanche Peak group, which next succeeds in descending order, is an important member of the series, and presents a greater development, both horizontally and vertically, than either of the others. It is made up of soft yellowish and whitish chalky limestone and buff and cream-colored limestones of greater or less compactness. The best exhibitions of this formation that we have seen are at Comanche peak, Shovel mountain, and at mount Bonnell, near Austin.

AUSTIN LIMESTONE (thickness, from 100 to 200 feet).—This subdivision consists of cream-colored and bluish limestone, and resembles in lithological features portions of the preceding group, but contains quite a different assemblage of organic remains. Some of the beds are soft, and crumble readily upon exposure, while others are moderately hard, and furnish a handsome building rock, which may be cut into almost any required shape with a common hand-saw. The state-house and several of the public buildings at Austin are constructed of this stone. This formation occurs at Austin, and near San Antonio and New Braunfels. Dr. Riddell also recognized it in McLennan and Bosque counties, and Dr. G. G. Shumard in Grayson county.

The greatest thickness observed is in the vicinity of Austin, where the beds are exposed to the height of about 100 feet.

EXOGYRA ARIETINA MARL (thickness, 60 feet).—This is an indurated blue and yellow marl, with occasional bands of gray sandstone and thin seams of selenite interstratified. It contains iron pyrites in the form of small spherical masses, and the fossils are also frequently studded with brilliant crystals of this substance. It is well exposed toward the base of mount Bonnell, near Austin, where it presents a thickness of about 60 feet. It may also be seen to advantage near New Braunfels, in Comal county, at various points in Bell county, and Dr. G. G. Shumard found it resting upon the limestone of Fort Washita, in Arkansas.

Fossils.—*Exogyra arietina*, *Gryphæa pitcheri*, *Janira Texana*, and a small undescribed species of *Dentalia*. On Shoal creek, near Austin, *Exogyra arietina* occurs in the greatest profusion, the surface of the ground being sometimes literally covered with them.

WASHITA LIMESTONE (thickness, from 100 to 120 feet).—This important member of our Cretaceous system is made up of a nearly white, yellow, gray, and blue limestone, some of the layers being moderately hard, while others disintegrate rapidly from exposure. This formation is exhibited at many locations in the state. Good exposures occur near Austin, and in Grayson, Fannin, and Red River counties. According to Dr. G. G. Shumard, it is finely developed near Fort Washita.

BLUE MARL (thickness, 50 feet).—This member was examined in Grayson county by Dr. G. G. Shumard, who describes it as an indurated arenaceous marl of a schistose structure, with small nodules of iron pyrites and irregular masses of lignite disseminated through it. It has not been recognized south of Grayson county. This subdivision should, perhaps, be grouped with the preceding. It corresponds with No. 2 of the Nebraska section.

CAPROTINA LIMESTONE (thickness, 50 feet).—The *Caprotina limestone*, which follows in descending order, forms the base of the upper Cretaceous, and is composed of light gray and yellowish gray earthy limestone, with intercalated bands of yellow marl and sometimes flint. It is exposed at the base of the hills near Comanche peak, and is seen underlying the Washita limestone near the Colorado, at the foot of mount Bonnell.

II.—LOWER CRETACEOUS.

For a knowledge of this division of our Cretaceous system I am indebted to Dr. G. G. Shumard, who has had excellent opportunities for examining it. He describes it as being composed of sandstones and gypseous and marly clays, the latter containing numerous septaria, filled with fossils. It is separable into two groups, namely, *Arenaceous* and *marly clay* or *Red river group*.

ARENACEOUS GROUP (thickness, 80 feet).—This member consists of light yellow and blue sandstone and beds of sandy clay, with crystals of selenite and some lignite. Its characters may be understood from the following section, taken by Dr. G. G. Shumard on Post Oak creek, in Grayson county:

	Feet.
No. 1. Soft, fine-grained, yellow sandstone.....	10
No. 2. Hard, fine-grained, blue sandstone, becoming yellow upon exposure, and sometimes passing into gritstone and fine conglomerate	5
No. 3. Yellow sandstone, same as No. 1	10
No. 4. Indurated, blue, slaty clay, with crystals of selenite	20
No. 5. Thinly laminated layers, same as No. 2	3

With regard to the Nebraska equivalent of our Arenaceous group, I think there can scarcely be a doubt that it represents No. 1 (perhaps the upper part) of the section of Messrs. Hall, Meek, and Hayden.

MARLY CLAY, OR RED RIVER GROUP (thickness, 150 feet).—This member immediately underlies the fish-bed of the Arenaceous group, and is described by Dr. G. G. Shumard as a blue marly clay, occasionally variegated with red and brown, and with thin bands of sandstone interstratified. The clay contains crystals of selenite, flattened nodules of compact brown and blue limestone, and septaria of compact blue limestone, reticulated with brown, yellow, and purple spar. The nodules occur in the upper, and the septaria toward the base of the formation. The best exposures of the group are in Grayson, on Post Oak, Choctaw, and Big Mineral creeks, where sections of from 50 to 60 feet have been measured. It occurs also on Red river in Fannin and Lamar counties. The estimated thickness of the group in this part of the state is about 150 feet; but we have not seen the base of the formation.

The age of the Llano Estacado or the Great Plains has been definitely determined as Cretaceous, from the occurrence of numerous characteristic fossils on the Pecos, and also at El Paso. The rotten limestone that outcrops throughout the southern portion of the plains and at the headwaters of the Colorado river seems to thin out or disappear toward the north, and the sections given in Captain Marcy's report on Red river represent the bluffs at the head of the south fork of Red river as "600 feet high, and composed of horizontal layers of drift and sandstone, interstratified with white limestone (5 feet), the inferior strata, or those between the base of the bluffs and the river, having been ascertained from numerous observations to consist of gypsum and red clay". No fossils are mentioned as occurring on the north. W. P. Jenney gives the following section of the bluff at Castle cañon, near Horsehead crossing, on the Pecos: (a)

The strata, beginning at the base, are arranged as follows:

1. A coarse red sandstone, without fossils, but probably of the Triassic age, 50 feet exposed.
2. Soft calcareous brown sandstone, with fragments of fossil shells. This bed is 50 feet in thickness, and probably of Cretaceous age.
3. Soft yellow limestone, 450 feet in thickness, containing an abundance of well-known Cretaceous fossils, including *Gryphaea pitcheri*, *Exogyra Texana*, *E. arietina*, etc.
4. Compact yellow limestone, 30 feet or more in thickness, wanting at Castle cañon, but forming the tops of the highest hills on the Llano, and also found on the tops of the mountains in Jones county.

The characteristic fossil of this bed is the *Caprina crassifibra*, which is very abundant.

The Cretaceous beds on the banks of the Rio Grande at El Paso contain fossils identical with those from bed 3.

The most southerly outcrop of the Cretaceous formation on the Rio Grande is probably at the mouth of the Las Moras creek, north of Eagle Pass, at which place were found the last Cretaceous fossils mentioned in the report of Arthur Schott, of the Mexican boundary survey commission. Southward from this the greensand rocks, blue clays, lignitic beds, and the white bluffs, 20 miles south of Eagle Pass, are doubtless Tertiary, the first-named being perhaps the continuation of similar rocks which I found in Lee county, on the northeast, and which overlies blue marls filled with Tertiary fossils.

The following description is given by Mr. Schott of the limestone south of the mouth of San Pedro river and north of Eagle Pass:

The limestone does not form such solid masses as that above the mouth of the river. The high table-lands change into a more rolling, sometimes broken country. The lithological characters of the rock becomes more earthy; its fracture sharper. That embraced in the section of country lying between the mouths of San Pedro and Las Moras, like that above, seems to be metamorphic; it, however, differs from that, in indication of having been subjected to the action of a higher temperature. The fossils occurring in these localities are of the Cretaceous age. As an essential characteristic, we cite here strata and shoals, consisting almost solely of entire and fragmentary pieces of *exogyra* and *arietina*. They appear either in a state of perfect preservation or as a real breccia, the cement of which is mostly an ochre-colored sand or clay.

He ascribes this change or metamorphism of the beds to their position on the axis of that eruption which apparently resulted in the hills of dark green basalt at the head of Leon~~a~~ river and on the west bank of the Frio, and which seems to have had its origin in Santa Rosa mountain, in Mexico. (a)

Salines.—In several counties of the timbered region in the northeastern part of the state there are salines or salt-works lying in a northerly and southerly course from each other. The salt is obtained from a stratum in wells 15 to 25 feet in depth, and limestone is said to be found in the localities. That these salines are but outliers of the Cretaceous formation there can be but little doubt, resembling, as they do, the salines of Louisiana, which have been recognized as Cretaceous by Professor E. W. Hilgard.

Tertiary.—The Eocene, or lowest division of the Tertiary, occupies all the northeastern part of the state between the Cretaceous and the eastern boundary, and extends south along the Louisiana line to the southeastern corner of Sabine county. A line marking approximately its southern limit would pass west from this point to Trinity, in Trinity county, to Burton, in the western part of Washington county (where the belt becomes narrow), and southwestward into the southern part of Gonzales county, and to Rio Grande City.

To what extent the Mississippi subdivisions of the Eocene are represented in Texas is not definitely known, but it seems probable that the lignitic covers the greater part of the region, its beds of lignite being found in many of the counties, both on the east and on the Rio Grande. In Lee, Nacogdoches, and Caldwell counties limestones, beds of fossils, and blue fossiliferous marls and greensand rock are reported, but their age has not been determined. The line of low hills at the eastern edge of the black Cretaceous prairie region in Limestone and Falls counties, known as the Tehuacana hills and Blue ridge, are composed of Tertiary rocks, with a few fossils, *Venericardia planicosta*, etc.; while northward, at Corsicana and Wills' point (in Van Zandt county), as well as on the southwest, near Bremond, are soft sandstones, with Tertiary fossil casts overlying lignite beds at 40 feet or more below the surface. The Claiborne group of white limestones and fossils has not been recognized in Texas.

On the Rio Grande the glauconitic sandstones, mentioned by Mr. Schott (b) as occurring along the river from the Cretaceous rocks at the mouth of Las Moras creek, north of Eagle Pass, southward to Roma, near Rio Grande City, are doubtless of Tertiary age and the continuation of the sandstone in Lee county, which overlies a bed of blue clayey marl rich in Eocene fossils. Their Tertiary position is corroborated by the fact that at Roma and vicinity Mr. Schott reports beds of fossil shell and large ostreas (*O. Georgiana*) as occurring in abundance. Lignite is abundant throughout this greensand region in beds sometimes 3 and 4 feet thick, and was found to contain monocotyledonous and dicotyledonous leaves and plants.

This extensive bed of greensand is of great value agriculturally, containing probably a large percentage of potash. It is this bed that contributes so greatly to the high fertility of the lands of the lower Rio Grande and gives to it the extreme amount of potash. It is not known to what extent the greensand rocks occur in the eastern counties, the outcrop in Lee being the only one observed. There are, however, in the counties of the timbered region of east Texas, and notably in San Augustine, Nacogdoches, and neighboring counties, beds of shell marl that might be advantageously used on the sandy lands of the region.

Immediately south of the Eocene there is a belt of sandstone extending across the state, that has been referred to the Grand Gulf, of probably Miocene age. Its northern limit enters the state at the lower part of Sabine county, and outcrops on the Trinity river near Trinity station, in Trinity county, forming a bluff of about 100 feet in thickness. In Washington county, near Chapel Hill and Burton, the sandstone appears near the surface exposed in the railroad cuts; in Fayette county, at La Grange, it forms a bluff over 100 feet high on the south side of the river; in De Witt county it outcrops in the high hills on the north and in the bed of the river at Hellgate ferry, near Cuero. Still southwest, from all that can be ascertained from reports and other sources, the upper limit of this group forms a line of hills via Oakville, Live Oak county, southwestward through Duval county to the Rio Grande, at Rio Grande City.

The width of the formation is not great, being covered with the Port Hudson clays on the south along the entire coast. On the east it probably includes the long-leaf pine region, while on the Rio Grande it does not, so far as known, approach nearer to the coast than Hidalgo, where the first line of sandstone hills comes to the river. The rock is usually very coarse in character, and rather a conglomerate, in which a coarse quartz grit is combined with a white siliceous clay as a cementing material. Sometimes it is massive in structure, and often thinly laminated and fine grained.

These sandstones contain no fossils so far as known, and identification of the group is dependent wholly upon the position and character of its rocks.

Quaternary, or stratified drift.—The superficial deposit of rounded sands, grit, and water-worn pebbles that represent the drift formation in other southern states is also found in Texas, and is confined chiefly to the Eocene and Grand Gulf groups, the timbered uplands of the streams, and the upper and lower cross timbers, the territory being overlaid to the seaward by the Port Hudson formation.

These deposits are very irregularly distributed, sometimes forming low hills or ridges of large pebbles and sand, as near La Grange, Bastrop, Gonzales, and many other places, or deep sand beds, that are found almost everywhere in the region mentioned north of the Grand Gulf. Agates and variously colored quartz pebbles are usually abundant in the drift beds, and silicified wood, in small and large fragments, is found in very many of the counties.

From Rio Grande City, Starr county, to the mouth of the Pecos and beyond rounded pebbles are said to cover the ground nearly everywhere, and among them are found some very fine agates.

Port Hudson.—The group in Louisiana to which the name of Port Hudson has been given by Professor E. W. Hilgard is described by him as consisting of a—

Blue-clay stratum, usually containing stumps or trunks of the cypress or other lowland trees, and extends not only over the entire alluvial plain of the Mississippi as high as Memphis at least, of Red river as high as Shreveport, and correspondingly in other larger tributaries, both of these rivers and of the Gulf of Mexico, but also over the entire coast region of Texas, Louisiana, Mississippi, and Alabama from the Rio Grande to the Escambia, and doubtless farther along the coast of Florida. It forms along these coasts the "blue-clay bottom" so well known to navigators, that generally, at a distance varying from 7 to 20 miles out from the mainland, breaks off into deep water.

In the bluff at Port Hudson, Louisiana, whence the group derives its name, these blue clays are overlaid by or associated with strata of gravel and sand in irregular bands, which contain leaves, wood, and mastodon bones. Overlying this is a stratum of yellow hard-pan from 18 to 25 feet thick, in turn underlying a yellow surface loam 4 to 10 feet thick. West of Port Hudson few outcrops or well profiles in the Opelousas and Anacoco prairies, from bayou Cocodrie to the Calcasieu river, reach below what are doubtless the equivalents of the upper portion of the Port Hudson bluff, viz, gray, yellow, or mottled siliceous silts or loams. * * * Near the latitude of lake Charles the soil of the Calcasieu prairie is directly derived from the stiff clay, with calcareous nodules, that crops out in the beds of streams.

In Texas these prairies continue westward to the Rio Grande, overlying the sandstones of the Grand Gulf and drift, and usually extending to the mainland coast. The silty soils or loams are prominent from the Sabine to the Brazos delta, but beyond that the formation is prominently represented by heavy yellow and dark colored gypseous or calcareous clays, inclosing white calcareous concretions and some limestone beds, and in it have been found (at Lavaca) the fossil bones and teeth of mammoth quadrupeds. These clays, when not covered by later sand deposits, form the heavy, black, waxy and hog-wallow prairie lands of the southern prairie region.

The immediate coast and islands of the Gulf are low and covered with sand beds and shells, but inland a mile, and often less, the surface of the country is 15 or 20 feet above the water, the stiff clays forming perpendicular bluffs along the bays and bayous. The formation is limited or covered on the southwest of Corpus Christi by the sands of what is termed "the desert" to within 50 miles of Brownsville, where are found again its characteristic stiff lands.

Other deposits.—The islands and the immediate coast are covered by beds and hills of sand, or "sand dunes", which are being constantly blown here and there by the winds; but the most prominent bed of sand in the state is perhaps that of "the desert" of the southwest, already alluded to. With its base reaching from the valley of the Rio Grande, 50 miles north of Brownsville, along the coast to within a few miles of Corpus Christi, it reaches inland or northwest, becoming more narrow near Laredo, and finally forms merely a broad dividing ridge 35 or 40 miles southeast of Eagle Pass. The sand-hills of the plains along the Pecos river are doubtless but a continuation of this desert belt. Rev. Mr. Hall, of Brownsville, describes this region as being "composed of pure white sand, studded over with live oaks, festooned with long moss".

The northern portion of the Llano Estacado is covered by a horizontal bed of drift material varying from 10 to 15 feet in thickness beneath the surface covering of soil. Dr. Shumard reports this sand as differing from that of the regular stratified drift, in being angular instead of rounded by attrition with water. The same is also said of the sands that form the hills, so prominent on the plains. From the drift bed Dr. Shumard obtained specimens of chalcedony, jasper, granite, obsidian, agates, and fossil wood.

AGRICULTURAL FEATURES.—The state of Texas, with its immense territory, naturally presents agricultural features greater in variety, perhaps, than those of any other state in the Union. Its position at the southwestern extreme of the agricultural regions of the south gives to a part of the state features similar in most respects to other southern states. Including, as it does, the southeastern borders of the great western plains, the lands of the western part of the state resemble those of New Mexico. Those of the gypsum formation and of the red-loam region seem only to extend northward into the Indian territory. The following agricultural regions may be conveniently distinguished:

1. Timbered upland region of east and central Texas:
 - Oak, hickory, and pine uplands.
 - Short-leaf pine region or pineries.
 - Red hill lands.
 - Brown and sandy loam prairies.
 - Long-leaf pine hills and flats.
 - Upper and lower cross timbers.
2. Southern and coast prairie region:
 - Country east of the Brazos.
 - Country west of the Brazos to the Nueces and Frio rivers.
 - Southwestern prairies and sandy "desert".
3. Central black prairie region.
4. Northwestern red-loam lands.
5. Western and northwestern uninhabited region:
 - Gypsum lands.
 - Llano Estacado or the Great Plains.
 - The mountain region.
6. River alluvial lands, including the Brazos delta, or "sugar-bowl".

THE TIMBERED UPLAND REGION OF TEXAS.

The timbered region, which name is popularly applied to all that part of the state lying east of the central prairies and southward to the coast prairies, and which here is made to include also "the cross timbers" of the former, embraces an area of 45,995 square miles. It covers the eastern part of the state from Red river southward to the marshes of the Sabine river, and extends southwestward, becoming more and more narrow, until it nearly reaches the Frio river, about 100 miles from the Rio Grande, where it ends.

The area, exclusive of the cross timbers, is 40,685 square miles, or greater than that of either Kentucky, Indiana, or Virginia. It includes all or the greater part of about 50 counties.

TOPOGRAPHY.—The surface of the country is more or less rolling throughout, while in the counties of Panola, Rusk, and in others in the central region, and in Lee and Bastrop on the southwest, there are prominent hills of Tertiary iron ore and ferruginous sandstone, forming a belt of interrupted red lands across the state in a northeast and southwest course. The entire country, with the exception of a few small prairies here and there, is well timbered with black, red, post, and black-jack oaks, hickory, and some short-leaf pine. In the extreme eastern counties, along the Louisiana line, and in the counties bordering the pineries, the short-leaf pine (*Pinus mitis*) is a very prominent growth, but in border counties along the black prairie it appears only sparsely.

Small insular brown-loam prairies are a prominent feature of the western side of the region along its entire length as far north as Red river. They also occur on the east around Boston, Bowie county, and in Cherokee county, and will be described among the special features of the region.

The region is crossed by all of the largest streams of the state, except the Nueces and Rio Grande rivers. They flow in a great measure parallel with each other southeast to the Gulf, each with its many small tributaries forming a separate drainage system. Water of excellent quality is abundant throughout the year from springs, wells, and the various larger streams. Summer rains are more frequent than in the regions westward, and crops do not usually suffer materially from droughts.

In the timbered uplands that border the bottom lands of Red river and southward for some distance in Red River county (as well as in the adjoining portions of Louisiana) are innumerable small mounds 3 or 4 feet high, and having diameters varying from 10 to 25 or 30 feet. They usually bear the growth of grass, shrubs, and trees that are found on these uplands, while in the depressions lying between the mounds there is little else than grass or weeds, growing on an impervious clay, and sometimes containing water, milky in appearance from suspended white clay. When exposed by the railroad excavations, the mounds are seen to have the same structure of sandy-loam soils and yellowish sandy subsoils that are observed in the pine lands of Bowie county.

The country is properly divided into three general divisions, the *oak, hickory, and short-leaf pine uplands*, the *long-leaf pine hills and flats*, and the *prairies*, which are interspersed throughout the former. In addition to these the *bottom lands* of the entire region will be separately described, those of Red river forming a division on page 41.

OAK, HICKORY, AND SHORT-LEAF PINE UPLANDS.

This group, as will be seen by the map, occupies nearly the entire area of the timbered lands southward to the southern part of Sabine, San Augustine, Polk, and San Jacinto counties, or 35,350 square miles. Its surface presents three general features, which are best described separately, viz: a region of prominent *short-leaf pine growth* on the east and southeast, known as "the pineries"; a belt of *red hill lands* occupying the central portion southwestward; and the *oak and hickory lands* proper, with some short-leaf pine growth. This region is more thickly populated than any other in the state, the average being a little more than 16 persons per square mile. The proportion of lands under cultivation (13.2 per cent.) is a very little less than that of the central prairie region, while the percentage of these devoted to the culture of cotton is 34.4, a far greater proportion than is found in any other part of the state. The cotton acreage per square mile is 28.4 per cent., corn being the chief crop of the region.

The short-leaf pine region.

This region, thus designated because of the prevalence of the short-leaf species of pine, embraces the eastern part of the county of Bowie, a large part of Cass, and portions of the counties south bordering the long-leaf pine region, and also extends in belts along the Nueces river, in Cherokee and Anderson counties, constituting what are often called "pineries".

The lands are generally but slightly rolling, and have light sandy or silty soils from 10 to 12 inches deep, a yellowish sandy subsoil two or more feet deep, and a red underclay. These depths vary greatly, the clay often coming near to the surface. The pine is interspersed more or less with oaks and hickory, and the bottom lands of the creeks that flow through the region have a growth of sweet gum, elm, oak, etc. The sandy nature of the land makes tillage easy. Drainage is good, and it is claimed that the lands will produce an average of 800 pounds of seed-cotton per acre in favorable seasons without the aid of fertilizers.

The following analyses are given to show the composition of the lands of the pine region:

No. 1. *Gray sandy soil* from Bowie county, near Texarkana, Arkansas. Depth taken, 12 inches; growth, oak, hickory, and short-leaf pine.

No. 2. *Yellow sandy subsoil* of the above, taken at from 12 to 20 inches.

COTTON PRODUCTION IN TEXAS.

Short-leaf pine lands, Bowie county.

	Soil.		Subsoil.	
	No. 1.		No. 2.	
Insoluble matter.....	95.197	96.174	88.802	92.339
Soluble silica	0.977		3.537	
Potash.....	0.047		0.046	
Soda.....	0.036		0.069	
Lime.....	0.274		0.228	
Magnesia.....	0.162		0.164	
Brown oxide of manganese.....	0.075		0.019	
Peroxide of iron.....	1.035		2.171	
Alumina.....	0.282		3.040	
Phosphoric acid.....	0.090		0.060	
Sulphuric acid.....	0.015		0.023	
Water and organic matter.....	1.456		2.074	
	99.646		100.233	
Available inorganic.....	0.640			
Available phosphoric acid.....	0.017			
Humus.....	0.410			
Hygroscopic moisture.....	1.760		3.900	
absorbed at.....	18 C.°		18 C.°	

The above analyses show that both the soil and subsoil are greatly deficient in potash, with low percentage of phosphoric acid, as well as vegetable matter, while a relatively large percentage of lime explains their present thriftiness. A fair yield in seed-cotton would probably be realized for two or three years, as the lime is sufficient to make available the little phosphoric acid that the lands contain, but durability cannot be expected.

The red hills.

Hills of ferruginous sandstone and concretionary iron ore occur in a number of the counties of eastern Texas, and notably in Cherokee, Cass, Marion, and Rusk. Southwestward the belt of iron ore and red lands extends beyond the Guadalupe river, but, with the exception of a few isolated hills, the country is not so broken, the rocks rather forming beds below the soils. The iron hills of Cherokee county are from 150 to 200 feet above the general level of the country, and are in some cases broad on their tops, while on the sides masses of iron ore outcrop in large and small fragments. The soil of the valley lands between these hills is full of ferruginous pebbles, making them, as is claimed by the farmers, more liable to drought.

The iron ore of these counties is usually a brown hematite or Tertiary ironstone, more or less concretionary in form, with often a matrix of ochreous clay, rich in iron. Furnaces were at one time in operation in a number of the counties, but have been either abandoned or destroyed. An interesting feature of these iron hills in the extreme eastern counties is their occurrence as isolated spots, surrounded by the forests of short-leaf pine and by poor sandy lands, except in their immediate neighborhood.

Red sandy and clayey lands occur in most of the counties of the oak and hickory region to a greater or less extent, but chiefly, so far as known, in Cass, Morris, Marion, Harrison, Smith, Cherokee, Rusk, Nacogdoches, San Augustine, Sabine, Houston, Anderson, Lee, and Caldwell. These red lands are considered best for corn and small grain, though cotton grows well and produces from 600 to 800 pounds of seed-cotton per acre. In Lee and some other counties the lands are enriched by a glauconitic limestone (Tertiary), which lies in fragments on the surface. The timber growth of the red lands is hickory, red and post oaks, sweet and black gums, and elm.

The following analyses show the composition of the red lands:

No. 4. A *dark loamy soil* near Palestine, Anderson county, taken 8 inches deep. Growth, hickory, white and black-jack oaks. Though the soil is more sandy than is the case perhaps elsewhere, both soil and subsoil may be taken as an average of the whole, the lands all being more or less sandy.

No. 5. *Red clayey subsoil* of the above, taken from 8 to 12 inches.

No. 6. *Red glauconitic soil* from the place of Mrs. E. R. Wilson, 6 miles north of Lexington, Lee county. Depth, 12 inches.

No. 35. *Red pebbly clay soil* from Harwood, Gonzales county, taken 10 inches. Timber growth, oak and hickory.

Red lands of the timbered region.

	ANDERSON COUNTY.		LEE COUNTY.	GONZALES COUNTY.
	Soil.	Subsoil.	Soil.	Soil.
	No. 4.	No. 5.	No. 6.	No. 35.
Insoluble matter.....	92.943 } 98.952	79.954 } 81.205	74.983 } 78.868	60.770 } 74.370
Soluble silica.....	1.009	1.251	3.885	13.600
Potash.....	0.111	0.067	0.718	0.446
Soda.....	0.093	0.060	0.131	0.077
Lime.....	0.147	0.108	0.258	0.389
Magnesia.....	0.077	0.012	0.530	0.209
Brown oxide of manganese.....	0.051	0.170	0.032	0.043
Peroxide of iron.....	1.614	8.478	9.333	9.623
Alumina.....	1.470	0.078	5.301	7.944
Phosphoric acid.....	0.193	0.194	0.102	0.283
Sulphuric acid.....	0.020	0.006	0.028	0.106
Water and organic matter.....	2.201	4.109	4.717	6.093
Total.....	99.920	100.547	100.018	99.633
Available inorganic.....			1.472	
Available phosphoric acid.....			0.035	
Humus.....			0.740	
Hygroscopic moisture.....	8.781	11.055	7.833	9.758
absorbed at.....	14 C.°	15 C.°	12 C.°	16° C.

The sandy soil and clayey subsoil of Anderson county are both deficient in potash, though they have fair percentages of phosphoric acid and lime.

The Lee county soil in its high percentage of potash shows the influence of the glauconite (greensand) that occurs in the rocks found on its surface. The amount of phosphoric acid, however, is rather low for a soil containing such high percentages of iron and alumina, and after a few years' cultivation the application of phosphatic manures to the soil are found to be necessary to insure its full productiveness. There are fair percentages of lime and of humus.

The Gonzales county soil is rich in all of its important elements, and should be highly productive and durable. It lies almost within the belt of iron-ore hills mentioned above.

The oak and hickory uplands.

The timbered uplands, in whose growth pine is almost entirely absent, covers the largest part of this division of the state, and lies between the central black prairie region on the west and the pineries and southern coast prairie region on the east and south. The region has a southwesterly course, reaching from the Red river on the northeast nearly to the Nueces river on the southwest, and while wide at first (from 60 to 100 miles), becomes narrow at the Brazos river, and is to the southwest interspersed with and penetrated by the southern prairies, the latter feature giving the appearance of long arms or peninsulas of timber extending out from the main region.

The oak and hickory lands proper present very much the same characters and productiveness throughout. Here and there we find such local exceptions as "post-oak flats", "sand flats," etc., which, however, will be mentioned only in the description of counties in which they occur.

The surface of the country is generally rolling, sometimes hilly; the soil sandy to a depth of about 12 inches, and is very generally underlaid by a good clay subsoil, usually red in color. Decayed leaves and other vegetation has given to the surface soil a dark color an inch or two deep, adding much to its productiveness.

The general timber growth of these lands is red, black, post, and black-jack oaks, and hickory, with a thick scrubby undergrowth, and some short-leaf pine. The crops of the region are cotton, corn, wheat, oats, sugar and sorghum-cane, pease, and upland rice. The uplands are best adapted to cotton, which comprises a large proportion of the crops. It usually grows to a height of 3 feet in dry and 5 or 6 feet in wet seasons, producing, it is claimed, from 800 to 1,000 pounds of seed-cotton per acre when fresh, and from 600 to 800 pounds after many years' cultivation. The lands wash readily when allowed to lie idle any length of time, but as yet any effort to prevent this is exceptional.

The following analyses are given to show the composition of these lands:

No. 3. *Sandy upland soil*, taken near Mineola, Wood county. Depth, 24 inches; timber growth, post, red, and black-jack oaks, hickory, and sumac.

No. 30. *Light sandy soil* from near Troup, Smith county, taken 12 inches deep. Timber growth, hickory, and post, red, and black-jack oaks.

No. 31. *Light yellow subsoil* of the above, taken from 12 to 18 inches. Overlies a yellow shaly sandstone.

No. 21. *Sandy upland soil* from McDade, Bastrop county, taken 12 inches. Timber growth, post oak. Ferruginous sandstone and pebbles occur on the surface.

Oak and hickory uplands.

	WOOD COUNTY.		SMITH COUNTY.		BASTROP COUNTY.
	Soil.		Soil.	Subsoil.	Soil.
	No. 2.		No. 30.	No. 31.	No. 21.
Insoluble matter	93.051	96.415	94.350	93.458	92.835
Soluble silica	3.304		0.525	1.820	2.206
Potash	0.114		0.111	0.148	0.195
Soda	0.074		0.105	0.080	0.095
Lime	0.031		0.076	0.090	0.172
Magnesia	0.061		0.061	0.031	0.112
Brown oxide of manganese	0.111		0.040	0.121	0.037
Peroxide of iron	0.611		2.052	2.337	1.145
Alumina	0.908		0.303	0.779	0.504
Phosphoric acid	0.169		0.237	0.295	0.195
Sulphuric acid	0.012		0.031	0.105	0.020
Water and organic matter	0.611		2.035	0.911	1.657
Total	99.117		90.926	100.175	99.173
Hygroscopic moisture	0.74		1.671	1.80	1.687
absorbed at	13 C. °		13 C. °	13 C. °	17 C. °

From these analyses it appears that all of the soils have a low percentage of potash and a rather large one of phosphoric acid (accounting for durability), the latter being greatest in the soil from Smith county. There is not, however, a sufficiency of lime to render the phosphoric acid available to any extent, except perhaps in No. 2, where it is a minimum quantity. The soils are quite durable, but liming or marling will doubtless render them more productive.

PRAIRIES OF THE EASTERN TIMBERED REGION.

SANDY PRAIRIES.—The prairies of the region differ from each other in character, those on the west partaking largely of the black waxy nature of the central prairies, while those on the east are lighter and sandy. In Cherokee county the latter are known as “brush prairies”, from the fact that they are rapidly being covered with a low scrubby growth of red, post, and black-jack oaks. The past eight years is said to have witnessed a great change in this respect, and is attributed to the fact that they are not now yearly burned off, as formerly was the case.

The soils of both these and the Boston prairies, in Bowie county, are light sandy or silty, and are not considered as productive as the adjoining timbered sandy uplands, the cotton-plant not growing as high, and yielding only from 500 to 700 pounds of seed-cotton per acre when fresh. The prairies are very level, those of the Boston being about a mile in diameter, and interspersed with clumps of trees.

BROWN-LOAM PRAIRIES.—In the counties of Navarro, Limestone, Grimes, Brazos, Burleson, and Lee there are high, rolling, and open prairies having a brown-loam soil a foot or two in depth and an underlying heavy clay, which in the prairie valleys or lowlands forms very heavy waxy lands, similar in every respect to the black prairies of the west. The largest of these brown-loam prairies covers a large part of the two first counties named, and lies along the eastern edge of the black prairie region, extending on the north and south into the adjoining counties, and covering an area of about 1,825 square miles.

In Limestone county and southward the western line of these prairies is marked by a low range of hills, treeless, and formed by a hard Tertiary limestone, which is in places fossiliferous, and forms rocky ledges along the summit.

The first of these hills, in the northern part of Limestone county, is known as “the Tehuacana hills”, here rather abrupt in character, but forming broad table-lands northward toward Corsicana. On the south the Navasota river cuts through the hills, the southern end then receiving the name of “Honest ridge”. The next in the line of ridges is “Horn hill”, about three miles in length; then “Big hill”, one mile long. “Buffalo Mop”, four miles south west of the latter, is a small but prominent elevation, forming a connecting link with the “Blue ridge”, the last of the chain of hills, and terminating, after a length of 10 miles, between Big creek and Little Brazos river, in Falls county, on the southwest. The entire range is of very much the same character throughout, is most abrupt on the western side, while on the east there is a broad and almost even prairie, extending with a slight slope to the timbered lands, and having in localities a low growth of mesquite trees (*Prosopis juliflora*).

In Navarro county the prairies are higher, and are rendered more broken by numerous streams, which have cut their way into them, and which now have heavily timbered and black bottom lands, with occasional oak and hickory uplands along their border, as along Chambers creek, east of Corsicana.

On the west and north of Corsicana are found Tertiary fossiliferous rocks, both in the banks of the streams and lying in fragments on the prairie, while on the east of Chambers creek the prairie lands have much quartz gravel of all colors, large and small.

The lands of these prairies have a rich brown-loam soil from 12 to 24 inches in depth and a heavy reddish clay subsoil. Mesquite growth is plentiful. The lands yield well, and are said to be very durable. Cotton grows well, often to a height of 4 or 5 feet, producing an average of about 800 pounds of seed-cotton per acre. It is stated that very little of this land that has been long under cultivation now lies turned out for rest, its productiveness being as yet but slightly diminished. A large proportion of these prairie lands has never been under cultivation, and still is used for pasturage.

The "San Antonio prairies" of Burleson, and those of Brazos and Grimes counties, are similar in character to these described, and the same and even greater productiveness is claimed for them.

The following analyses show the composition of the prairie lands:

No. 7. *Sandy prairie soil*, taken near Tehuacana, Limestone county. Depth, 12 inches; a little mesquite growth.

No. 34. *Dark sandy prairie soil*, taken 2 miles west of Corsicana, Navarro county. Depth, 10 inches; no timber growth.

Brown-loam prairie soils.

	LIMESTONE COUNTY.	NAVARRO COUNTY.
	No. 7.	No. 34.
Insoluble matter.....	92.949	87.557
Soluble silica.....	1.421	5.183
Potash.....	0.140	0.117
Soda.....	0.096	0.070
Lime.....	0.194	0.320
Magnesia.....	0.009	0.101
Brown oxide of manganese.....	0.030	0.083
Peroxide of iron.....	1.433	1.638
Alumina.....	0.907	2.394
Phosphoric acid.....	0.358	0.220
Sulphuric acid.....	0.081	0.110
Water and organic matter.....	2.124	2.023
Total.....	99.832	100.515
Hygroscopic moisture.....	3.499	4.750
absorbed at.....	18 C.°	19 C.°

These two soils each have a low percentage of potash. That from Limestone county, while rich in phosphoric acid, is rather deficient in the lime necessary to render it fully available. The Navarro soil, on the contrary, has a sufficiency of lime to render available for a time the fair amount of phosphoric acid it contains. Both soils are sandy, and lack vegetable matter.

SALINES.—Salines occur in several of the counties of these eastern timbered regions. The largest of these is in Van Zandt county, and covers several hundred acres of land. Much salt has been obtained from the water of the wells at a depth of 18 or 20 feet. Much smaller salines occur in Smith county. They cover but a few acres, and are reported to be surrounded by hills, in which is found limestone (probably Cretaceous, as in the salines of Louisiana).

BOTTOM LANDS OF THE TIMBERED REGION.—Under this head are included only the lands of the smaller streams, those of the large rivers comprising a separate division, viz, alluvial lands, which will be found on page 41.

Sulphur Fork river lies mostly within this region on the northeast, and is parallel with Red river, to which it is tributary, and flows almost due east. Its bottom lands, as well as those of the neighboring White Oak and Big Cypress creeks, have a dark and heavy loam soil, quite deep, and overlying a stiff bluish clay. They have a timber growth of hickory, pecan, ash, walnut, and white oak, with pin, burr, overcup, and Spanish oaks. Cotton is very much inclined to run to weed on these lands, and is represented as producing as much as 1,500 pounds of seed-cotton per acre in favorable seasons.

Angelina and Neches rivers, in their separate courses, belong to this division, uniting soon after they enter the pineriës. Their bottom lands are from one-fourth of a mile to 1 mile in width, and have a timber growth of oak, elm, hickory, beech, and walnut, with an undergrowth of cane, bamboo, muscadine, and wild peach. The soil is a black loam from 2 to 4 feet deep, over a heavy clay subsoil. Cotton grows to a height of 5 feet, and is said to yield, when fresh, as much as 1,500 pounds of seed-cotton, or from 800 to 1,000 pounds after five years' cultivation. The hummock

lands that border these bottoms have a width of from one-fourth to $1\frac{1}{2}$ miles, and a timber growth of pine, oak, hickory, and ash. The soil is said to be a heavy whitish-brown clayey loam from 12 to 24 inches deep, underlaid by a heavier subsoil and by gravel at a depth of 6 or 8 feet. It yields, when fresh, from 500 to 800 pounds of seed-cotton, or from 400 to 700 pounds after five years' cultivation.

Narasota river bottom is said to have very much the same character of soil and growth as that of the Brazos, to which its waters are tributary. A very high yield is claimed for both, viz, over a bale per acre.

The bottom lands of the *Yeguas* (creeks lying between the Brazos and Colorado rivers) are not much under cultivation, as they are subject to overflow. They have a timber growth of pin oak, pecan, elm, ash, and hackberry. When cultivated they yield, it is said, about 1,400 pounds of seed-cotton per acre. The bottom lands of the *Guadalupe river* are subject to overflow, and therefore are not under cultivation. Its valley lands are rich and productive, having a dark loamy or often a black prairie soil, 2 or 3 feet deep, over a gray clayey subsoil, and at 10 feet a bed of sand and gravel. Cotton grows usually from 5 to 8 feet in height, and yields about 1,400 pounds of seed-cotton per acre.

LAKE BOTTOM LANDS.—The bottom lands of Little Cypress river and Caddo lake, in Harrison county, are from 2 to 3 miles in width, and have a timber growth of pin and overcup oaks and pine, cypress in the marshes, and blue-jack oak and myrtle thickets along the borders of the lake. The soil is black and stiff, and water stands on it during half of the year. The creek bottoms in the same county have a growth of red oak, sweet gum, hickory, red elm, chinapin, and bitter pecan. These lands are not extensive, and are little in cultivation.

On the Sabine river, in Rusk county, there are some cypress swamps. The creeks of the county have a bottom growth of white, red, post, and overcup oaks, ash, maple, and hickory, and a fine sandy soil 18 inches in depth, overlying a compact clay, and said to produce from 1,000 to 1,200 pounds of seed-cotton per acre.

THE LONG-LEAF PINE REGION.

The region thus designated does not include all of that part of the state in which the long-leaf pine is found, but, as in Georgia and other states, is meant to represent only lands that are so sandy as to support a timber growth of little else than this species of pine.

In Sabine, Panola, and other counties there are large areas covered with a prominent growth of this timber, associated with such hard woods as oak and hickory, and having clay subsoils. They thus differ from the lands in the more southern counties, and are properly classed with the oak, hickory, and pine region.

The poorer lands, or the long-leaf pine region proper, merge into the better class so gradually that it has been found impossible with the information at hand to define their limits with extreme accuracy, and therefore the outlines as given on the map must be considered simply as general.

The long-leaf pine region, or "pineries" as it is called, comprises both hills and flats, and embraces the counties of Newton, Jasper, Tyler, Orange, and Hardin, the southern parts of Sabine, Angelina, Trinity, San Augustine, and Nacogdoches, the eastern and southern part of Polk, and probably the southeastern part of San Jacinto, as well as areas in Shelby and Panola and elsewhere. It covers an area of about 6,000 square miles. The "flats" are found in the southern part of the region between the Trinity and Sabine rivers, and form the western limit of the pine flats of Louisiana and other states. The rest of the region is more rolling and well timbered, chiefly with long-leaf pine, and forms the western extreme of that great belt of pine timber so prominent from Texas to the Atlantic coast.

The northern part of the pine region in Texas is interspersed with open prairies having a variety of soils, from sandy to stiff black loams and clays, and is similar in position and other features to the Anacoco prairie of Louisiana. The timbered uplands have but little else than dark or gray sandy soils, with mostly sandy subsoils, sometimes to a depth of several feet, and are not considered very productive. The country is sparsely settled, with an average of about five persons per square mile. The chief industry of the people is the cutting and shipment of lumber.

The lands under cultivation are chiefly the hummocks that lie along the creeks and larger streams. Their soils are sandy to a depth of many inches, and have a growth of oaks, hickory, beech, walnut, magnolia, etc. It is claimed that these lands will produce as much as 1,500 pounds per acre when fresh and 800 pounds after eight years' cultivation; 2.1 per cent. only of the area of the region is under cultivation, and that is mostly devoted to corn. The cotton average is 3.4 acres per square mile, comprising 25.6 per cent. of the tilled lands, with an average yield of 615 pounds of seed-cotton per acre.

THE CROSS TIMBERS.

The name of "cross timbers" is popularly given to two wide belts of timbered lands that extend southward from Red river; the one, or "lower", in the central part of the black prairie region; the other, or "upper", on the features.

The belt of the "*lower cross timbers*" enters the state from the Indian territory immediately to the east of the big bend of the river north of Gainesville, Cooke county, the stream having apparently been turned north by the belt.

Southward it has an average width of from 10 to 15 miles, extends to the Brazos river, in McLennan county, a distance of 135 miles, and covers an area of about 1,720 square miles. Its western edge is marked by the towns of Gainsville, Denton, and Cleburne, while Fort Worth is within a few miles to the west of this limit. The belt is thickly timbered with a growth of post and black-jack oaks, and has a deep sandy soil. Its surface is rolling, and there is a line of low hills of gray and ferruginous sandstone and conglomerate along its center, and quantities of small and brown ferruginous gravel cover the surface in many localities. On either side of the belt the sandstone seems to thin out, the underlying limestone and fossil beds of the prairies sometimes appearing near the surface. Wells have been dug to a depth of 40 feet in the belt through sands and clays without reaching the rotten limestone that characterizes the adjoining prairies. Some lignite is reported on the north. In many points along its course the general surface of the belt is lower than the adjoining prairies, and the general features of the lower cross timbers almost lead to the conclusion that at some time a deep trough-like valley connected Red (perhaps the Canadian) and Brazos rivers, probably forming the bed of the former river and conveying its waters to the Gulf through the present channel of the Brazos, and that by some agency this valley was filled with clays and sands and the present channel of the river formed.

The soils of the uplands are generally very sandy for a foot or more in depth, and are not considered valuable. Along the streams and in the lowlands the soil is a dark sandy loam with a clay subsoil, rich and productive. On it cotton grows 4 or 5 feet high, and, it is claimed, yields as much as 1,500 pounds of seed-cotton per acre even on lands that have been several years under cultivation.

The "*upper cross timbers*" also leave Red river at the foot of a long southeast bend, and pass south through the middle of the county of Montague with a width of 10 or 15 miles, covering probably 3,500 square miles. At the lower edge of the county it divides, the eastern portion passing south through Wise and Parker to the Brazos river; the other a little westward, and more interrupted in its character, extending far south into Erath county, and forming, as it were, a line of separation between the black prairie and the western red-loam regions in this part of the state.

Between these two prongs in Parker county there are high and bald hills of rotten limestone of the black prairies, and on emerging suddenly at their feet from the thickly-timbered and quite level belt that lies between them and the Brazos on the west a person is struck with their prominence. To the south can be plainly seen the high points of Comanche and other peaks rising above the line of ridges. The belt is throughout its length and breadth interspersed with small and open prairies. The lands are the same in character as those of the lower cross timbers, the uplands, with their deep sandy soil (often little else than pure white and deep sand), having a timber growth of scrubby post and black-jack oaks, and the lowlands, with their dark loam soils and growth of ash, cottonwood, pecan, and hackberry, producing an average of 1,000 pounds of seed-cotton per acre.

The following analyses show the composition of the soils of these two belts:

No. 17. *Sandy soil* of the "*lower cross timbers*" from near Arlington, Tarrant county, the eastern edge of the belt, taken 8 inches deep. Timber growth, post and red oaks. This is a representative of the better class of level lands of the region.

No. 26. *Sandy upland soils* of the "*upper cross timbers*" from near the stage crossing of Leon river, Comanche county, taken 12 inches deep. Timber growth, post oak almost exclusively.

Lower and upper cross timbers soils.

	TARRANT COUNTY.	COMANCHE COUNTY.
	Lower cross timbers.	Upper cross timbers.
	No. 17.	No. 26.
Insoluble matter.....	85.086 } 90.999	90.360 } 97.538
Soluble silica.....	5.318 }	1.176 }
Potash.....	0.218	0.209
Soda.....	0.079	0.058
Lime.....	0.342	0.038
Magnesia.....	0.174	0.205
Brown oxide of manganese.....	0.015	0.081
Peroxide of iron.....	2.460	0.487
Alumina.....	2.672	0.671
Phosphoric acid.....	0.093	0.121
Sulphuric acid.....	0.045	0.030
Water and organic matter.....	2.785	0.889
	99.886	100.336
Hygroscopic moisture.....	4.435	1.023
absorbed at.....	18 C.°	12 C.°

These two soils, while containing very nearly the same proportions of potash and phosphoric acid, respectively, differ greatly in several other particulars, the advantages being with that of the lower belt, No. 17. This soil is less sandy, has much more of iron and alumina, and, what is better still, a fair amount of vegetable matter and a large percentage of lime. The latter is amply sufficient to render available the small percentage of phosphoric acid. There is a deficiency in the lime percentage in No. 26, but the potash in both soils is present in fair proportions.

SOUTHERN COAST PRAIRIES.

The coast of Texas is bordered by a low and level prairie, reaching from the marshes of Sabine Pass westward to the densely timbered Brazos alluvial basin, and thence westward, with scarcely any interruption, to the Rio Grande, excepting the narrow timbered lands of a few streams. While there is a similarity in some of its features throughout its length, yet certain portions of the coast have such marked peculiarities as to merit a division into three groups for purposes of description. These are *the prairie region east of the Brazos alluvial*, *the prairie region west of the Brazos alluvial*, extending to the Nueces river, and *the southwestern prairie region*, lying between the Nueces and Frio rivers to the Rio Grande. The entire region embraced is about 47,680 square miles, which is about the area of the state of Mississippi.

EAST OF THE BRAZOS ALLUVIAL REGION.—In the southeastern part of the state, lying between the Brazos and the Trinity rivers, and extending eastward to the Neches, there is a large region of level prairie lands, having large areas each of *gray silty* and *black waxy* soils, interspersed with "motts" of pine or oak, and intersected by timbered streams. The region extends from the coast inland into the counties of Waller, Montgomery, and San Jacinto, and includes besides these all or portions of Jefferson, Liberty, Chambers, Galveston, Brazoria (eastern part), and Harris.

The prairies of the northeastern part of the division usually have gray silty soils, and deserve more properly the name of "pine prairies"; but where the underlying Port Hudson clays approach the surface the result is a black waxy soil. On the northwest of the city of Houston, and extending nearly to Hempstead, in Waller county, there is but little to break the monotony of a level and open prairie. Southward to the coast the prairies extend almost uninterruptedly, covering areas of from 20 to 30 miles in breadth, and are characterized by the absence of all growth other than grasses and occasional motts of large live-oak trees. Along Buffalo bayou and other streams the uplands are well timbered with oak and pine, and in the immediate vicinity of the streams the magnolia (*Magnolia grandiflora*) is a large and prominent growth. The trees, and especially the live oaks, are very generally festooned with the greatest abundance of the long moss (*Tillandsia usneoides*) so common in the coast region of all of the southern states. The surface of the entire region is very level and even, with a descent to the coast so gradual as to afford no drainage to the soils, and, as a natural consequence, water remains in pools upon the prairies of the region until removed by evaporation.

The immediate coast lands from the marshes of Sabine river westward to the Brazos alluvial are almost entirely open prairies with a light sandy soil, becoming darker inland, and underlaid by a white concretionary clay. This latter comes to the surface near Clear Creek station, 19 miles from the shore-line. Small natural mounds from 10 to 20 feet in diameter and several feet high cover some parts of this coast region. At Allen's station, about 40 miles from the coast, the subsoil changes to a yellow clay with calcareous concretions.

The soil of the region is very generally a light sandy loam, underlaid at varying depths by heavy impervious clays. Large areas of black clayey lands occur along the border of the Brazos alluvial, and eastward to Harrisburg and beyond the Trinity river, which are very similar to those described on the west of the Brazos.

As shown by the analyses given below, the loam prairie lands of the region are well supplied with the mineral elements necessary for fertility, but from their want of proper drainage are not under cultivation. They are given up entirely to grazing purposes and the production of hay, for which the thick carpet of grass that covers them is admirably suited. The farms of the region are found in the timbered uplands that border Buffalo bayou and some of the streams.

No. 9. *Grayish sandy prairie soil* from near Pierce's junction, 5 miles south of Houston, Harris county; taken 8 inches deep.

Sandy prairie loam soil, Harris county.

	No. 9.
Insoluble matter.....	80.860
Soluble silica	3.613
Potash.....	0.291
Soda.....	0.197
Lime.....	0.653
Magnesia.....	0.272
Brown oxide of manganese.....	0.174
Peroxide of iron.....	2.401
Alumina.....	6.079
Phosphoric acid.....	0.156
Sulphuric acid.....	0.075
Water and organic matter.....	5.313
Total.....	99.584
Available inorganic.....	1.691
Available phosphoric acid.....	0.024
Humus.....	2.132
Hygroscopic moisture.....	10.683
absorbed at.....	13 C.

This soil has a fair amount of potash and of phosphoric acid and a large percentage of lime, which would render them both productive and durable. The absorptive power is also great.

WEST OF THE BRAZOS.—One of the prominent features of the southern and coast prairie region is the large area of *black and stiff or waxy lands* that occupies a central position between the Sabine and Rio Grande rivers and reaches from the coast northward into Washington county. In the counties of Calhoun, Victoria, Jackson, and the western parts of Matagorda and Wharton these prairies are very broad and extensive, with a gradual rise from the coast inland for 20 or 30 miles, and then become slightly rolling, the view interrupted here and there by the timber growth of the streams or "motts" of mesquite and live oak. On Lavaca bay there is much Mexican scarlet bean (*Erythrina*) and a few "Brazil-wood" trees. Northward, in the counties of De Witt, Lavaca, Colorado, Fayette, Washington, and Austin, the prairies are smaller, and are interspersed with sandy and timbered uplands and sandy prairies. In adjoining portions of Gonzales and De Witt counties there are high and rolling sandy prairies, underlaid by sandstone (Grand Gulf). In the lowlands and flats of these the soil is often a heavy black clay. On either side of the alluvial lands of the Brazos and adjoining streams, in Fort Bend and Brazoria counties, or the "sugar-bowl", there are other strips of black prairies.

As far inland as Clinton, in De Witt county, and Columbus, Colorado county, the prairies are underlaid by heavy light and blue-colored clays (Port Hudson) full of calcareous concretions, and often containing crystals of gypsum. They form bluffs from 15 to 25 feet high around Lavaca bay and the inland lakes, and in them have been found large fragments of the bones of extinct mammoth animals. Limestone also occurs to some extent in these beds. Excellent grass covers the lands of the region, and the prairies are almost entirely devoted to the grazing of stock, the sandy timbered lands of the streams being used for farming purposes. The entire country is very sparsely settled, "nearest neighbors" being generally many miles apart. But little cotton is produced in the counties along the coast, but as we advance inland we find that crop receiving more attention, over one-third of the tilled land of the upper counties of the region being devoted to cotton culture.

The soil of these prairies is black waxy or adobe in character, tenacious, and very difficult to till in wet seasons, while in dry weather it becomes hard, and shrinks, forming deep and wide cracks—traps, as it were, for the feet of the unwary beast. Hog-wallow lands are found in localities throughout the region, a feature resulting from the shrinkage and subsequent swelling and bulging out of the underclay upon access of water through the cracks when the winter rains come. The soil has a depth of from 12 to 24 inches, and overlies a lighter-colored and stiff clay, which sometimes contains gravel. The lands are thought to be best adapted to corn. Cotton grows to a height of from 3 to 5 feet, the yield being variously estimated to be from 600 to 1,000 pounds of seed-cotton per acre when fresh and after long cultivation. Some planters place the estimate much higher.

The following analyses show the composition of these prairie lands in several sections of the region:

No. 8. *Black prairie soil* from Schulenberg, Fayette county, taken 12 inches deep.

No. 10. *Black waxy prairie soil* from near Victoria, Victoria county, taken 12 inches deep.

No. 11. *Black prairie upland soil* from Chapel Hill, Washington county, taken 12 inches deep.

Southern black prairie soils.

	FAYETTE COUNTY.	VICTORIA COUNTY.	WASHINGTON COUNTY.
	Soil.	Soil.	Soil.
	No. 8.	No. 10.	No. 11.
Insoluble matter.....	74.172 } 82.298	55.436 } 77.851	75.530 } 87.718
Soluble silica	8.126	22.415	12.183
Potash.....	0.374	0.429	0.235
Soda.....	0.309	0.213	0.145
Lime.....	0.905	1.050	0.948
Magnesia.....	0.968	1.062	0.477
Brown oxide of manganese.....	0.162	0.064	0.056
Peroxide of iron.....	3.602	11.280	2.266
Alumina.....	4.639	1.245	4.161
Phosphoric acid.....	0.163	0.093	0.108
Sulphuric acid.....	0.332	0.280	0.075
Water and organic matter.....	5.572	5.914	3.741
Total.....	99.584	99.511	99.025
Available inorganic.....		4.002	
Available phosphoric acid.....		0.036	
Humus.....		2.764	
Hygroscopic moisture.....	11.730	14.110	7.982
absorbed at.....	16 C. ^o	17 C. ^o	17 C. ^o

These soils are well supplied with every element of fertility except phosphoric acid, which should be larger in such lands. Of the latter, the Fayette county soil contains an amount that may be considered a little more than a minimum for high productiveness and durability.

THE SOUTHWESTERN PRAIRIE REGION.—The southwestern part of the state lying west of the Nueces and Frio rivers is almost entirely a prairie region, and includes the agricultural counties of Frio, McMullen, and Duval, and the counties of Maverick, Zavalla, Dimmit, La Salle, Webb, Encinal, Zapata, Starr, Hidalgo, and Cameron (the latter two, however, having large areas of river lands, described on page 46), which properly may be included in what is termed "the desert".

The entire country is very sparsely settled and almost exclusively devoted to stock raising. Mesquite and a scrubby chaparral variety, with occasional live-oak trees and cacti, are almost the only growth, giving to the region a barren and desolate appearance. "The desert" is a broad area of white sand lying along the border of the Laguna de la Madre from a few miles south of Corpus Christi to the Rio Grande alluvial lands at the mouth of the Sal Colorado, and extending back (westward) to within a few miles of the Rio Grande, and up that stream to near Eagle Pass, as reported by Rev. Mr. Hall, of Brownsville.

The following is taken from a description of this region (in the *Texas Almanac* of 1868) by Ex-Governor E. J. Davis:

At Corpus Christi bay the high lands of the interior come down to the bay, and part of the town of this name is built upon a bluff nearly 50 feet above the water-level. I believe this is the highest land anywhere on the Gulf coast within the territories of the United States.

About 20 miles southwest of Corpus Christi commence the famous sands which border the Laguna Madre down to the Sal Colorado. These sands are quite remarkable. Extending in a northwesterly direction from the coast, they reach within 20 miles of the Rio Grande. They lie across the country in a wedge shape, of which the base lies on the Laguna. In many places these sands form bare hills, rising from 50 to 100 feet above the grassy plains, and being of a light-yellow color are landmarks of the country and visible at great distances. The sands have evidently been formed by the prevalent southeasterly winds, which have blown them across from Padre Island. Like similar formations in England and other parts of the world, where history aids the observer in accounting for them, it is likely that they constantly progress inland under the influence of the southeast wind, and will probably reach or cross the Rio Grande in course of time.

This district, after leaving the coast country just described, becomes rolling and gradually hilly. On the extreme northwest it borders on the outlying hills or mountains of the "Staked Plain" (*Llano Estacado*), but within its limits there are no very high elevations, though the general level of the northwestern part is nearly 1,000 feet above the sea.

There is a distinctly marked range of hills crossing the territory from northeast to southwest which deserves special notice, not only because it presents an interesting natural feature of the country, but because of the indications of valuable minerals found in the range. * * * This range commences in the western side of Karnes county, at the place called "Rocky". It passes across the Nueces a short distance above Oakville, and strikes the Rio Grande a few miles below Carriza, Zapata county. The "Zancajo" hill (or mountain), in Duval county, is part of the range; and in the southern part of that county, and in Zapata county, it presents quite a marked feature, and is called by the Mexicans "La Sierra".

On the Rio Grande, from the commencement of the hills, the country is much more broken than anywhere east of it. From Rio Grande City (Ringgold) up to Eagle Pass, as the road winds along the river, high mountains, the offshoots of the Sierra Madre of Mexico,

are never out of sight on the western horizon. This is not an agricultural region. In nothing is the increasing dryness of the climate as you proceed west and south more noticeable than in the growth of vegetation. The cypress, magnolia, dogwood, and other trees of a moist and temperate climate, common in eastern Texas, pretty much disappear on the Colorado. The pine reaches the river near Bastrop, and the cedar is seen on the hills north of San Antonio. But none of these trees are found in the country I am describing. Post-oaks and live oaks are found between the San Antonio and Nueces rivers, and the latter is common in the "sands" south of Corpus Christi, but they go no farther southwest. I believe the only trees on the Rio Grande which are indigenous to eastern Texas are the ash, elm, cottonwood, and hackberry. The eastern man who goes southwest will find another system of vegetation gradually supplanting that to which he has been accustomed. The mesquite tree, which is in the desert, can send its roots far down in search of moisture, and with its bright pea-green leaves becomes a prominent feature of the landscape. The "Spanish bayonet", an endless variety of the cactus, and a dozen or more species of scrubby, thorny shrubs, known under the general designation of "chaparral", the product of a climate of great droughts, form in many parts an almost impenetrable jungle. On the Rio Grande the ebony tree becomes common, and is a handsome tree when full grown. There is also found a very ornamental and graceful tree called the "Tepajaque", which is nowhere found north of the Rio Grande valley.

All the trees and vegetation, and even the native animals, birds, and insects, seem especially adapted to a dry climate.

But if this country is too dry for planting purposes we are compensated in another way. Many years' experience has shown that Texas is the best stock-raising state in the Union, and for the same business this country is certainly the best part of Texas. The very dryness of the climate, in preventing the growth of trees to shade the soil, enables fine and nutritious grasses to abound. It is the paradise of horses, sheep, and cattle.

The following descriptions have been taken from the reports of surveying expeditions. The first is from Lieutenant T. N. Michler, (a) and describes the country from Corpus Christi northwest along the Nueces, Frio, and Leona rivers to the foot of the plains:

To San Patricio the road is over a high rolling prairie, with the exception of two sand flats, each two or three miles in length. The prairie is covered with fine mesquite grass and interspersed with mesquite trees and motts of live oaks. Sand-hills occur near the river south of San Patricio. At the Nueces river, 70 miles from Corpus Christi, the prairies come to the river. Limestone forms the bed of the stream, and cottonwood, elm, and oaks are found on its border.

Northwest, along the Frio, the high rolling prairies continue with mesquite trees and grass. Some parts of the river are timbered with growth given above, and, from one to two miles out, a thick growth of chaparral, with mesquite and cactus of every description. The first "mountains occur about 15 miles from the junction with the Nueces"; they set into the river in a direction perpendicular to its course. The distance between them is generally about a mile from base to base, extending but a short distance back into the country, and then gradually merging into the high prairies between the rivers. They approach to within a mile of the river, and then abruptly break off in the form of a pair of steps, and are covered with loose stone and almost impassable chaparral. As a general thing the lands on both the Frio and the Leona may be divided into four parallel strips; the first, next to the river, consisting of heavy timber and a heavy black soil; the second, a mesquite flat, of small width, and the soil of a lighter nature, and very fertile; the third, a range of low hills covered with loose stone and thick chaparral; the fourth, a wide open prairie, the soil generally very dry, but covered with excellent grass, which generally is very scarce close to the river; sometimes a second line of chaparral hills is found beyond the prairie land. Each of these strips is distinct, and parallel to the general course of the river.

Along the Frio, northward to its junction with the Leona, there are dense chaparrals a mile or two in width, but westward there are high and rolling prairies, extending as far as the eye can reach. Along the Leona northward the valley for the first 10 miles is about a mile wide, and bounded by low chaparral hills, difficult to penetrate, and extending from the ford to the headwaters of the river. After 14 miles the valley widens to 16 miles, and gradually becoming more elevated, it spreads out into a high flat prairie, and extends on unbroken until it rises into the range of hills which stretch across from the Frio—miles above the head springs of the Leona. This prairie (black Cretaceous) is very heavy in wet weather.

The following is made up from extracts selected from the report of Major Emory of the Mexican boundary survey, and describes the country along the Rio Grande:

West of the Nueces, and between that river and the Rio Bravo [Rio Grande], the want of rain makes agriculture a very uncertain business, and as we approach the last named river this aridity becomes more marked, and the vegetation assumes a spinose stunted character—indeed, so marked is the change, that when we get within a few miles of the river the vegetation is a complete chaparral. West and south of the Nueces the country is sometimes exposed to excessive and long continued droughts, and it is doubtful if agriculture can be made profitable without irrigation. All the region between that river and the Rio Bravo is, however, a fine grazing country.

This section of country is traversed by deep gullies, called arroyos, sometimes difficult to pass in wagons. These arroyos are natural consequences of the unequal manner in which the rain falls throughout the year. Sometimes not a drop falls for several months; again it pours down in a perfect deluge, washing deep beds in the unresisting soil, leaving behind the appearance of the deserted bed of a great river. The streams which are found in this country have their rise in limestone regions, and the water is very unwholesome even when the stream is flowing; but usually the beds of the streams are partly dry, and the water is found standing in holes. Superadded to its noxious mineral ingredients, it holds in solution offensive vegetable matter, and is disgusting to drink.

As we ascend above Brownsville, lands within the water-level (bottoms) become more frequent and extended, and at many places cultivated fields form a prominent feature in the landscape. Up as high as Reynosa the belt of alluvial soil subject to the influence of the moisture from the river is very considerable in width, and, in addition to corn, the sugar-cane has been planted with success. The foliage on this portion of the river indicates a richer soil, and the trees assume very much the dimensions of those on the alluvial bottoms of the Mississippi.

Reynosa is built on a low Cretaceous (b) ridge, and it is here the first rocks above the surface are seen; yet none appear on the immediate banks of the river until we reach Las Cuevas, some distance above, where we find a stratum of Cretaceous (b) sandstone 10 or 15 feet thick. At the last-named point, and thence up the river, there is also a marked diminution in the quantity of bottom land susceptible of cultivation, and vegetation changes its character, becoming more dwarfed and spinose. The uplands on either side impinge closely upon the river, and the vegetation is principally mesquite and cactus. On the Texas side, as we recede from the river, the chaparral gives place to the open prairie, covered with luxuriant grass. This character of the river lands extends, with little variation, up to Ringgold barracks.

The beautiful town of Roma, 16½ miles above Ringgold barracks, is the present head of steamboat navigation; it is built upon a high bluff of yellowish sandstone, containing ferruginous nodules.

Just above Roma, at the foot of the island of Las Adjuntas, and at several other localities in the neighborhood, are banks of fossil oyster-shells of great size, some of them measuring 18 inches in length. (a)

I have noted at Roma the occurrence of sandstone studded with nodules of ferruginous composition. Throughout the section between the San Juan river and Laredo septaria and strata of yellowish and green sandstone frequently occur. Often the nodules of more durable substance project beyond the weather-worn surface of the softer sandstone, producing picturesque appearances.

The land from Belleville to Laredo is not altogether barren; there are many flats on which the water of the river could be brought for the purposes of irrigation.

The country around Laredo is much the same as that described about Ringgold barracks, but is more elevated and more frequently intersected by dry arroyos, which give evidence of more frequent and copious falls of rain.

From Eagle Pass upward, extending along the river 70 miles, until within 5 or 10 miles of the mouth of the San Pedro, or Devil's river, the country is the most fertile and desirable portion of the whole Rio Bravo for settlement. On the Texas side it is watered by the beautiful, limpid streams of Las Moras, Piedras Pintas, Zocaté, and San Felipe, which come into the Rio Bravo at right angles and at equal intervals. A very extensive region of land is here within the water-level, and can be successfully irrigated.

On the mesas, or table-lands, which are unsuited to the purposes of cultivation, many plants are found growing useful in medicine and dyeing, and various yuccas, dasylirions, and agaves, genera well known for their useful fibers. There are also extensive growths of shrubs and trees of the leguminous order, furnishing gums, tannin, and nutritious pods, highly relished by the herbivorous animals, wild and domestic.

Ascending beyond the mouth of the San Pedro, or Devil's river, the whole character of the country changes. The bed of the river becomes hemmed in by rocky mural banks, the tops of which are beyond the reach of irrigation; and, from the aridity of the climate, they can never be made subservient to the purposes of agriculture. The general formation of the country is limestone, deposited in strata perfectly horizontal, and, where the river has washed its way through the banks, presents the appearance of gigantic walls of dry-laid masonry. The course of the river from this point up to Fort Teton, near the Presidio del Norte, a distance of 387 miles, is almost one continuous cañon, utterly unsuited to navigation, and, with a few exceptions, unsuited for settlement. Occasionally this limestone formation, over 1,000 feet in depth, is broken through and upturned by igneous eruptions from below, forming stupendous mountains and gorges of frightful sublimity.

THE CENTRAL BLACK PRAIRIE REGION.

One of the most prominent features of the state is the broad region of high, rolling, and black waxy prairie lands, lying in the central part of the state, from Red river on the north south-southwest to San Antonio, and thence westward. A line marking the eastern limit of the region would begin on the east of Paris, in Lamar county, at the southern edge of the timbered river uplands, pass in a southwest direction to the east of Terrell, in Kaufman county, and 4 miles west of Corsicana, in Navarro county; thence south to Cameron, in Milam county, southwest to a point a few miles south of San Antonio, and westward to the edge of the great plains of the west. The western limit of the region has not been fully determined, except that it passes from Montague south through the counties of Wise, Parker, Erath, Comanche, Lampasas, Burnet, and Blanco; thence west through Gillespie and Kimble. The region has a width of about 140 miles on the north, 100 in the middle, and is quite narrow on the south, not more than 50 or 60 miles. It embraces twenty-three and parts of twenty-six counties, covering in all about 26,050 square miles. A white rotten limestone (Cretaceous) underlies the entire region, and often appears on the surface. The eastern part of the region throughout its length is composed of prairies, slightly rolling, and interrupted by frequent streams, which are bordered with narrow timbered valleys. In its central part is the broad belt of "lower cross timbers", extending southward from the Red river to the Brazos, near Waco, in McLennan county, and which has been described elsewhere (see page 28). To the west the country is more and more rolling and broken, the bald hills on the extreme west standing out in bold relief as isolated peaks and prominent ridges, with high and abrupt sides facing the broad prairie valleys. Rotten limestone, accompanied by beds of Cretaceous fossils, outcrops everywhere on the sides of the hills, in the valleys, and in the beds of the streams. On analysis by M. E. Jaffa (University of California), it was found to contain:

	Per cent.
Insoluble residue	11.451
Iron and alumina	3.648
Carbonate of lime	82.512
Carbonate of magnesia	1.189
Total (b)	98.800

Some 7 miles on the west of Weatherford, Parker county, the prairies come to a sudden and abrupt termination, and the stage road descends 100 or 200 feet into a broad and level timbered post oak and black-jack region several miles in width, which forms a part of the "upper cross timbers belt", and reaches to the Brazos river, in Palo Pinto county. From this high prairie point a fine view is obtained over the timbers westward for 20 or 30 miles to the hills of the northwest red-loam region, while southward the bald hills, including Comanche peak, in Hood county, are plainly visible, though many miles away.

On the north of Weatherford, 12 or 15 miles, another high prairie occurs within the belt of cross timbers, and the road to Jacksboro', after passing over a high plateau of a gryphaea conglomerate, suddenly descends into the timbered lands of the northwestern red-loam region.

a Probably *Ostrea Georgiana* of the Tertiary (Vicksburg).—R. H. L.

b Water and alkalies not determined.

On the south, after crossing the Brazos river, the transition from the central black prairies is not so abrupt, and while high and bold limestone ridges, with almost perpendicular sides, occur near the border, yet the prairie valleys are more gradually merged into the mixed prairies and timbered lands of the west.

In Lampasas county there is but a narrow strip of sandy timbered lands lying between the black prairies and Colorado river, while immediately on the west bank of the river the high red sandstone hills rise abruptly 100 feet or more above the valley.

In its general level the country rapidly rises from the east toward the west, the altitude of Dallas being 481 feet; Fort Worth, 30 miles westward, 629 feet; Weatherford, 35 miles still westward, 1,000 feet. The latter place is near the western border of the region. On the south Austin has an elevation of 650 feet, San Antonio 575 feet, while Fredericksburg, 60 or 70 miles to the west, has an altitude of 1,614 feet above the sea. From San Antonio northwest to Cibola the country is a rolling prairie, becoming more and more hilly, and covered with clumps of live oak and other timber. Thence to the Guadalupe river the hills increase in height, with alternating rolling prairies and flats. Limestone is abundant all the way to Fredericksburg. The country northward is well wooded, and granite begins at 17 miles.

The following is taken from Captain French's report (a) on a route westward from San Antonio to the Rio Grande:

The road to Castroville runs through a generally level prairie, covered with a luxuriant growth of grass; the soil is good and well adapted to cultivation and grazing. The Medina is here a clear, bold, and rapid stream, about 30 yards wide, flowing between banks that rise near 50 feet in height on either side. From Castroville the road leads over some gentle hills, and thence through a tract of land pretty well timbered, until it opens out into what is known here as a hog-wallow prairie. Beyond this prairie is an elevated ridge, from the top of which spread out before him the traveler sees the beautiful valleys of Quihi and Hondo, pent in by the blue hills in the distance. The valley of Quihi is sparsely covered with timber, chiefly mesquite and oak.

From the Hondo the road stretches over a prairie country to the Seco, crossing a hog-wallow that, owing to late rains, we found nearly impassable. Thence westward the country is undulating for several miles; then opens out into a level prairie, which continues to Rancho creek, 8 miles distant. The Sabinal is bordered with large trees, and westward to the Frio the country is more rolling and diversified; the growth of small mesquite bushes begins to take the place of the open prairie. The banks of the Rio Frio are high, presenting in places a wall of limestone of considerable height. Its bed is covered with well-attributed limestone, and its edges are bordered in many places with oaks of large growth. Prairies extend westward to Leona river, a stream having a dense forest along its banks, on either side a quarter of a mile in width. The Nueces is bordered with a sandy bottom land nearly a half-mile in width, and heavily timbered with large trees. Beyond the river the country becomes slightly hilly; limestone rocks are abundant, the hills are stony and barren, and the rich loam soils are found only in the valleys.

Mesquite is a common growth of all the prairies of the central prairie region, but especially in the south, where, with a height of from 10 to 15 feet, it forms rather dense thickets. The "chaparrals" of this part of the state are formed mostly of a low thorny growth of what is known as "wesatche", belonging probably to the mesquite family.

SOILS OF THE PRAIRIE REGION.—The lands comprise three varieties, viz: Black waxy prairie, or "adobe", covering the greater part of the region; black sandy, occurring in localities along the borders of the former, and forming a transition to the sandy lands that border the streams; besides these are the bottom lands, the most important of which are described under the head of "river lands". The first of these varieties, or the *black waxy lands*, are what their name would indicate—a heavy, deep black, and tenacious clay, possessing a very high absorptive power (14 to 17 per cent.). Their extreme tenacity is illustrated and appreciated by the luckless teamster who has to drive his wagon across one of these prairies during a wet season. The black mud adheres in great masses to the wheels, filling up the spaces between the spokes and spreading out on either side, thus making an empty vehicle a load in itself for a team. The mud sticks in masses to the feet of those attempting to walk over these lands in wet weather. In dry weather the prairies assume altogether a different aspect; the roads become very hard and comparatively smooth, and the soil cracks open in every direction.

Hog-wallow lands.—The underlying rock of the region, rotten limestone, comes to the surface very often, though chiefly on the high uplands, being covered to a greater depth by the soils in the lowlands. The soils have a general depth of from 12 to 24 inches, the only perceptible difference in the subsoil being a change in color from a black to a lighter yellow or drab-colored clay.

The lands are very productive and durable, yielding about 800 pounds of seed-cotton per acre, both when fresh and after long cultivation. Many farmers claim a greater yield, but this is exceptional. The plant grows to a height of from 4 to 6 feet, and is very often troubled with blight, or "dying in spots" in the dry seasons at a time when it has about begun to bloom.

Black sandy prairie lands.—These are formed by the commingling of the black waxy just mentioned and the sands of the upland timbered lands, which are usually adjoining. They are generally underlaid by the heavy clay subsoils of the prairies. These lands are comparatively easy to till, and are fully as productive as the waxy lands of the prairies. The plant grows 3 or 4 feet high, yielding from 800 to 1,000 pounds of seed-cotton per acre.

These prairies are usually level, and present excellent farming lands.

The timbered uplands that border the streams in narrow belts have gray sandy soils, 10 or 12 inches deep, and a yellowish clay subsoil. They are usually called "post-oak lands", from the predominance of that timber growth.

Hickory, elm, and mesquite trees are also common. The lands are easily tilled, well drained, and produce well, and are therefore most preferred for agricultural purposes. Cotton grows to a height of from 2 to 3 feet, and it is claimed that it will produce as much as 800 pounds of seed-cotton in good seasons.

The bottom lands of the creeks are narrow and hardly worthy of mention, those of the rivers and large streams only being under cultivation. The timber growth of all of the bottoms is live and pin oak, elm, pecan, hackberry, etc. The lands are described under the general division of "river lands". (See page 41.)

The following analyses are given to show the composition of the lands of the region:

No. 27. *Black sandy soil*, Wills' Point, Van Zandt county, taken 10 inches.

No. 12. *Black sandy prairie soil* from 1 mile south of Ennis, Ellis county, taken 10 inches deep.

No. 15. *Black prairie soil* from 6 miles northeast of McKinney, Collin county, taken 12 inches deep.

No. 14. *Black waxy prairie soil* from 2 miles west of Cleburne, Johnson county, taken 12 inches.

No. 13. *Black waxy prairie soil* from 8 miles northeast of Marlin, Falls county, taken 12 inches.

No. 33. *Black waxy prairie soil* from 8 miles southwest of Waco, McLennan county, taken 12 inches. This soil is said to be a typical sample of the best class of these prairie lands.

No. 36. *Black prairie soil* from near Lampasas Springs, Lampasas county, taken 12 inches.

Black prairie lands.

	VAN ZANDT COUNTY.	ELLIS COUNTY.	COLLIN COUNTY.	JOHNSON COUNTY.	M'LENNAN COUNTY.	FALLS COUNTY.	LAMPASAS COUNTY.
	Black sandy soil.	Black sandy soil.	Black waxy soil.	Black waxy soil.	Black waxy soil.	Black waxy soil.	Black waxy soil.
	No. 27.	No. 12.	No. 15.	No. 14.	No. 33.	No. 13.	No. 36.
Insoluble matter.....	77.582 } 87.762	82.513 } 86.200	46.145 } 68.886	60.354 } 65.917	34.082 } 53.428	51.797 } 73.153	50.380 } 57.529
Soluble silica.....	10.180 }	3.687 }	17.241 }	5.563 }	10.344 }	21.356 }	7.190 }
Potash.....	0.265	0.291	0.610	0.365	0.447	0.718	0.305
Soda.....	0.130	0.162	0.188	Trace.	0.120	0.200	0.155
Lime.....	0.323	0.588	7.454	9.780	15.352	3.643	16.070
Magnesia.....	0.257	0.391	0.830	0.708	1.229	1.594	0.102
Brown oxide of manganese.....	0.042	0.056	0.409	0.030	0.059	0.020	0.255
Peroxide of iron.....	2.892	1.708	4.210	5.346	4.226	8.083	4.092
Alumina.....	4.423	4.008	11.073	5.746	5.900	4.202	0.048
Phosphoric acid.....	0.115	0.053	0.151	0.178	0.589	0.455	0.347
Sulphuric acid.....	0.156	0.144	0.104	0.047	0.060	0.044	0.102
Carbonic acid.....			1.875	6.594	10.388	1.082	9.550
Water and organic matter.....	3.608	6.237	9.510	5.255	7.592	5.896	6.900
Total.....	99.973	99.893	99.852	99.906	99.478	99.789	99.515
Humus.....		2.250			2.304		
Available inorganic.....		2.010			1.996		
Available phosphoric acid.....		0.040			6.039		
Hygroscopic moisture.....	6.366	8.938	17.013	11.400	14.530	18.240	12.150
absorbed at.....	14 C.°	13 C.°	13 C.°	13 C.°	13 C.°	13 C.°	29 C.°

These analyses show a percentage of potash from medium to large in all of the black prairie soils; also of lime in all. Phosphoric acid is deficient in the first two given, has a minimum percentage for high fertility and durability in the third, while in the last three the proportions are large, showing soils of high productiveness and durability. The amounts of organic matter are also high, and in No. 33 show the presence of much humus. The percentages of magnesia in the soils are also high, except in No. 36.

The central prairie region is but sparsely settled outside of the towns and cities. The houses and farms are mostly situated in or near the timbered uplands, the prairies, with their excellent grasses, being reserved almost exclusively for the grazing of cattle. The level nature of the land, and the comparative freedom from rocks, render it especially well adapted to the use of improved cultivators and other agricultural implements. The seasons of summer and fall are always very dry, which, though sometimes cutting off the cotton crop as much as one-third, never produce a total failure. The droughts are felt most by other crops, and in the scanty supply of water for stock and for domestic uses. Creeks and branches become dry, and the dependence is upon "tanks" or artificial ponds and cisterns filled by the winter and spring rains. Wells are unreliable, and their waters are to such an extent impregnated with lime and other salts from the rotten limestone as to make them unfit for domestic purposes.

Within the past few years much interest has been taken in artesian wells, and a number have been bored in Dallas and Fort Worth, from which a bountiful supply of good water is obtained at a depth of 300 or 400 feet in the former and 700 feet in the latter place, or below the rotten limestone. They are probably practicable throughout this region at a depth of not exceeding 1,000 feet.

NORTHWESTERN RED-LOAM REGION.

West of the upper cross timbers and the black prairie region there is a large region embracing what is known as the red lands of the northwest. It enters the state from the Indian territory, and extends westward and southward to the gypsum formation and the plains, while a large section passes southeast nearly to Austin and Fredericksburg. In this latter portion of the belt the red lands are not as prominent as farther north and west, and are associated with gray sandy soils, from the granites and other rocks that occur to a large extent. The entire region covers an area of about 27,012 square miles, and embraces twenty-five organized counties, besides those that have as yet been only outlined and named.

The surface of the eastern counties of the region is hilly or "mountainous" and broken, and is well supplied with timber. These hills are usually long, high, and narrow ridges or divides, generally not more than 100 feet high, with rather abrupt sides, are covered with a heavy growth of post and black-jack oaks, and have a sandy soil. Sometimes, as in the southern part of Brown county, the summit is broad and comparatively level, with only a low and stunted oak growth. The valley lands between these hills are broad and open prairies, with red soils and occasional clumps of mesquite bushes, interspersed with motts of live oak. In the low flats, where limestone is often found outcropping, the soil is a dark stiff or waxy clay, very productive.

The surface of the country in the western part of the region is little else than a high rolling prairie, somewhat hilly on the north, but more and more level on the southwest, where, with a gradual rise, it merges into the Great Plains, or southern part of the Llano Estacado. The surface is covered with grass and frequent chaparrals, and in localities with mesquite trees and motts of live oak. Red sandstone is perhaps the most prominent rock of the region (except on the south), and is found capping the great majority of the hills in ledges and broken masses of sometimes many feet thickness. Blue crystalline limestones (Palæozoic) also occur abundantly.

SOILS.—On the prairies and in the valleys the greater part of the lands of the region are of a red loam character, more or less sandy, and quite deep. In some of the low mesquite flats in Brown, San Saba, Stephens, and other counties on the east are found areas of stiff black clays with a growth of live oak, while the summits of the hills are sandy and often covered with a low scrubby undergrowth. The streams are usually bordered with a timber growth of elm, pecan, cottonwood, etc.; their valleys on the west are very narrow, but widen eastward to some extent, and are covered with rich and productive soils from the red-clay hills of the gypsum formation and bluffs of the Llano Estacado.

The following analysis has been made of a sample of the red upland soil:

No. 16. *Red loam soil, prairie near Jacksboro', Jack county, taken 10 inches deep. Covered with a growth of mesquite bushes.*

Red loam soil, Jack county.

	No. 16.
Insoluble matter.....	74.945
Soluble silica	8.651
Potash.....	0.425
Soda	0.163
Lime.....	0.125
Magnesia	0.882
Brown oxide of manganese	0.150
Peroxide of iron	5.050
Alumina	5.076
Phosphoric acid.....	0.095
Sulphuric acid	0.047
Water and organic matter	4.805
Total	100.354
Available inorganic.....	0.400
Available phosphoric acid.....	0.014
Humus	0.898
Hygroscopic moisture.....	10.840
absorbed at.....	18 C.°

This analysis shows the presence of a large amount of potash, a fair percentage of lime and magnesia, and a low percentage of phosphoric acid. The yield of fresh lands is about 800 pounds of seed-cotton per acre, but durability can hardly be expected in these uplands without the application of phosphates after a few years.

The region is almost exclusively devoted to stock raising, for which purpose the excellent grasses are well adapted. The long droughts, and consequent lack of water in the streams and wells, is the chief evil to contend with in all the various interests in which the people are engaged; but with an increased population and a development

of the resources of the country this lack in water supply will, in part, probably be overcome. At present cotton culture, and in fact every agricultural pursuit, is confined almost altogether to those counties on the extreme east most accessible to markets, though the extreme limit of production in this census year is in the county of Jones, more than 100 miles west of the black prairie region.

It is only in the last few years that the western tide of immigration has reached the most eastern of these counties, and five years ago the Indians roamed over a large part of the region and made their raids as far east as Hood county, in the black prairie country. Even the most eastern counties are still very sparsely settled, the county-seats usually containing the bulk of the population.

Of the valley lands of the western part of this country, at the headwaters of the Colorado river, Captain Marcy says:

Immediately after we descended from the high table-lands we struck upon an entirely different country from the one we had been passing over before. We found a smooth road over a gently undulating country of prairies and timber, and abounding with numerous clear spring branches for 200 miles, and in many places covered with a large growth of mesquite timber, which makes the best of fuel. The soil cannot be surpassed for fertility; the grass remains green during the entire winter, and the climate is salubrious and healthy; indeed, it possesses all the requisites that can be desired for making a fine agricultural country.

The following is taken from the report of Lieutenant F. T. Bryan on a route from San Antonio to El Paso, (a) via Fredericksburg, and is descriptive of the southern part of the region:

The first granite outcrops were seen 18 miles north of Fredericksburg; sandstone also appears, and the country is covered with a reddish sandy soil. Northward to the Llano river the prairies and timber lands are found alternating; some portions of it are hilly, large granite outcrops are found occasionally, and the soils are light and sandy, and sometimes red in color. To the San Saba the country continues rolling and hilly; some of the hills are rocky and precipitous, and when within 3 miles of the river large slabs of limestone appear, both on the hills and in the bed of the stream. Still northward to Brady's creek the country continues hilly; "rotten limestone" occurs on the hills, and the prairies are covered with mesquite bushes and grass. Westward to Kickapoo creek the country is a level and open prairie, with mesquite wood sufficient only for cooking purposes. The timber on this and other creeks consists of live oak and pecan, of large size. Still westward the prairies becomes hilly, stony, and barren, being a succession of gentle undulations and depressions covered with broken pieces of limestone. There is an absence of anything like timber on these prairies. This continues to Green Mounds, near the head of south Concho river, where the broad and level prairies are entered.

WESTERN AND NORTHWESTERN TEXAS.

The country lying west and southwest of the northwestern red-loam region, and forming the unpopulated portion of the state, is as yet comparatively unknown, especially so with regard to its agricultural features. It embraces sixty-three counties (unorganized), which, though having a name, have virtually no inhabitants, and lie in a wild and desolate region, including what is known as the Panhandle of Texas. The great extent of its territory, the lack of water and fuel on the plains, and the many other difficulties attending travel and explorations, make its examination a matter of much time and expense, as well as danger. At present we are largely dependent upon the reports of the United States exploring expeditions, made many years ago, for the little that is known regarding the great western plains.

Three important divisions are represented in this region, viz, the gypsum formation of the northwest and the plains, including the celebrated Llano Estacado or Staked Plain, the southern plain, and the mountainous region west of the Pecos, embracing in all 111,500 square miles, or 42.51 per cent. of the area of the state. The three divisions will be considered separately.

GYPSUM REGION.

One of the most interesting as well as valuable features of the western region is the great area of gypsum lands, covering in Texas, as far as can be determined, about 17,500 square miles. Dr. George G. Shumard, who explored this region with Captain Pope, reports that on Red river the gypsum beds are from a few inches to 30 feet thick. On Delaware creek, a few miles below its source, they are 60 feet, while between the Big Wichita and Brazos rivers there are hills nearly 700 feet high, composed almost entirely of this material. It occurs in its many different forms of granular, massive, fibrous, and in large plates of transparent selenites, and is associated with heavy beds of red clays, and overlaid by sandstones and drift deposits. The exact limits of the region have not as yet been determined. The best source of information are United States Pacific railroad survey reports.

The following is taken from Marcy's *Red River Report of 1853*, page 163:

I have traced this gypsum belt from the Canadian river in a southwest direction to near the Rio Grande in New Mexico. It is about 50 miles wide upon the Canadian, and is embraced within the ninety-ninth and one hundredth degrees of west longitude. Upon the north, middle, and south forks of Red river it is found, and upon the latter is about 100 miles wide, and embraced within the one hundred and first and one hundred and third degrees of longitude. I have also met with the same formation upon the Brazos river, as also upon the Colorado and Pecos rivers, but did not ascertain its width. The point where I struck it upon the Pecos was in longitude 104 1° west.

In the same report (page 184) Dr. Shumard, in his notes under date of July 22, makes the last mention of gypsum outcrops. The survey party were then returning eastward, and on the divide between Beaver and Rush creeks, just east of the ninety-eighth degree of longitude and south of the thirty-fifth parallel, in the Indian territory. In Texas gypsum is reported (in Thrall's *History of Texas*) as occurring in Hardeman, northwest Baylor, Haskell, and Knox counties, and also on the headwaters of the Colorado river. A line, therefore, connecting these points would probably mark the true easterly limit of the formation. The bluffs of the Llano Estacado form the western border of the region northward across the headwaters of the Brazos and south fork of Red river, and along the one hundredth degree of longitude to the Canadian river.

The surface of the country is represented to be a vast open and rolling prairie, somewhat broken on the east, with abrupt hills or large mounds of gypsum and red clay 50 feet high and a gradually increasing elevation westward to the foot of the plains, where the beds of gypsum are observed only in ravines and cañons. The soil of the uplands is thin and sandy, supporting a growth of gramma grasses only; that along the streams and in the valleys is a reddish loam, thought to be very productive with irrigation, and is covered in some localities with fine grasses. A few cottonwood trees are found along some of the large streams, with occasional pecan, elm, and hackberry, while on the bluffs are brakes of stunted red cedar (*Juniperus Virginiana*). Wild grape-vines 4 feet high were observed on Red river. The streams are usually very narrow, and their beds are mostly composed of quicksands. The water is largely impregnated with salts from the gypsum beds, except where the source of the river is westward of the formation, as Captain Marcy found to be the case with regard to the south fork of Red river.

In the Red river section of the region belts of sand-hills, with a width of many miles in places, border the river. These hills are about 30 feet high, rounded in form, and without vegetation, except occasional dwarf-oak bushes, wild onions, and grasses.

THE LLANO ESTACADO, OR THE STAKED PLAIN.

The northwestern and the extreme western part of the state is part of what is known as the "Llano Estacado", or the "Staked Plain", the name being given to it from the tradition "that in 1734, when the fathers from Santa Fé visited San Saba to establish a fort and a mission, they set up stakes with buffalo heads on them, so that others might follow their route". The name is usually given only to that portion lying east of the river Pecos, in both Texas and New Mexico, but the plains proper extend westward to the Rio Grande. From the northern limit of the state it reaches southward nearly to the twenty-ninth parallel, its eastern border lying along the 101st meridian, through five degrees of latitude, thence turns eastward to McCulloch county, and south to Bandera. The area embraced in Texas is about 74,500 square miles, or about 28 per cent. of the entire area of the state. On the north the eastern limits of the plains are strongly defined, and, according to Captain Marcy, are marked by vertical bluffs about 800 feet above the country or gypsum formation on the east. These bluffs consist of red and yellow clays, overlaid by 10 or 15 feet of sandstone, and a heavy deposit of drift pebbles, the whole capped by a sandy soil and subsoil. Southward, at the headwaters of the Colorado, the bluffs are not so high, a descent of only 50 feet being noted by Captain Marcy, and limestone (probably Cretaceous) is found at its foot. This rock, as reported, seems to underlie the entire plains south of the thirty-second parallel, and is almost absent in the Panhandle region, appearing only in thin seams in beds of sandstone. Throughout the rest of the border on the east and south the line marking the limit between the plains and the regions east can hardly be defined; the country is broken and hilly, with valleys, canoñs, and isolated ridges, in which rotten limestone (Cretaceous) occurs abundantly.

The surface of the plains presents a vast and level prairie, "as smooth and firm as marble," apparently boundless; the soil is chiefly a brown loam, sometimes sandy, and with no vegetation other than gramma and mesquite grasses and small mesquite shrubs, which appear a few inches above the surface and serve the purpose of a guide to the large roots below—the firewood of the plains. Alkali ponds or lakes occur frequently, especially in the southern half, and also a number of springs whose waters are suitable for use. Some gypsum is said to occur around the edges of the lakes. The height of the eastern part of the plains was estimated by Captain Marcy to be 2,450 feet above the sea. Westward the country gradually rises 200 feet, and reaches its maximum near the one hundred and third degree of longitude.

On this line, near the southwest corner of the Panhandle, there is a range of sand-hills rising from 20 to 100 feet above the plain, occupying a region 50 miles long (north and south) and about 15 miles wide. The hills are conical in shape and utterly destitute of vegetation, and the section, because of the deep beds of sand, is hardly passable with wagons.

From this point westward the country falls some 200 feet to the Pecos, whose banks are without timber growth. A person may come very near to the edge of the gorge without becoming aware of its presence. From the river still westward to the foot of the Guadalupe mountains the country rises 200 feet, and thence to the Rio Grande, at El Paso, again gradually falls.

Country from the mouth of the Wichita river southwestward across the plains to the Pecos.[Extracts taken from the report of Lieutenant N. H. Michler; *Reconnaissance in New Mexico and Texas.*]

The distance from the Red river to the main fork of the Brazos is about 96 miles. The route for this entire distance lay upon the divide between the Big and Little Wichita, with the exception of the last 10 miles, which crossed the divide between the Wichitas and the Brazos. It passes over a slightly rolling prairie, with intervals for miles of perfect dead level flats. A more beautiful country for roads of any kind cannot be found. Near the Red river the soil is slightly sandy, and you meet with a few post-oak motts. It then becomes a fine mesquite country, well timbered with mesquite, and for miles perfectly level, and even when a rolling prairie the elevations and depressions are small. The grass at first is principally gramma and the ordinary sedge and their species, but then comes the fine early mesquite and the winter mesquite. The whole extent was well watered by numerous branches of the two Wichitas. Most of the streams possessed a slightly brackish taste; all of them were well timbered.

Crossing the divide, you travel over a continuation of the mesquite range, and come to the Brazos river without the slightest indication of its presence. No timber along its banks as far as the eye can see, you stumble upon it without any forewarning. High bluff banks along its very edge conceal it until you reach the top of them. Its channel is about 50 yards in width, and bounded by a small strip of bottom land. Owing to its red sandy bottom the waters have a reddish appearance, though clear and free from mud. The Indians call this stream the Colorado, and much more deservedly than the one bearing that name on the map of Texas. The water is exceedingly brackish. Small streams of fresh water are found emptying into it, which will serve every purpose. In the bottom was good grazing of sedge and water-grass, and on the top of the bluffs again spread out the mesquite flats. Near the Red river the formation seemed to be sandstone, but on the Brazos we found some beautiful limestone. The bluffs were white with the large limestone rocks that lay strewn on their surface.

On rising the bluffs of the main fork of the Brazos we again found a continuation of the mesquite flats, over which we traveled until we reached the head of the Double Mountain fork of the Brazos. Day after day the country was almost perfectly level. One exception alone can be made; a distance of 4 or 5 miles over some high sand-hills, perfectly destitute of grass, and covered with a low scrub oak, the rest was either mesquite flats or a very slightly rolling mesquite country. There was but little timber upon the streams after leaving the main fork of the river, but the farther we advanced the more we found, elm being the principal growth. The whole country was timbered with mesquite. Double Mountain fork has a gravelly bottom, and in a few places a hard limestone bottom; the banks are generally high, the prairies extending to the edge of them. For 70 miles westward from the Brazos the country is mountainous, but now assumes new features. High mounds and low ridges come in sight, being a succession of spurs or oblong mounds overlapping each other, separated by deep ravines and gullies. Two high peaks form prominent landmarks near the head of Double Mountain fork; limestone abounds on them, and live oak and cedar are first seen.

Westward from the Brazos and Colorado divide the country undergoes a complete change; we meet with high and rolling prairies, arid, destitute of timber, and with scarcely any grass but of the most miserable kind. Occasionally we cross low sand-hills containing some low cedar and scrubby oak. This country extends to the "Big springs of Colorado", which are very large, covering a space of about 20 feet square, and in some places 15 feet deep. They are walled in by a ledge of conglomerate limestone, formed by numerous shells, united by a siliceous cement. The surface of the ground around is covered with angular fragments of limestone; the soil is chiefly sand. Westward the road lay over a high, arid plain, perfectly destitute of timber, scarcely a sprig of mesquite, except in the neighborhood of water-holes. For miles the country would be a perfect level, and then a slightly rolling prairie; it seemed destitute of all growth of any kind, and nothing was to be seen upon it excepting the antelope, wolf, and prairie-dog town. Occasionally a small spot of mesquite was found. This continued to the commencement of the low sand-hills, a distance from the "Big springs" of 76 miles. The Mustang springs, 21 miles from Big springs, are in a low prairie of about 100 acres in extent, in form nearly circular, and bounded by low bluffs, principally of white limestone.

The sand-hills for the first 12 miles are low ridges of sand running parallel with each other, plains of the same kind interspersed between them, with small hillocks. The sand was here of a black color. Then come the white sand-hills, which are really an object of curiosity. They are a perfect miniature Alps of sand, the latter perfectly white and clean; in the midst of them you see summit after summit spreading out in every direction, not a sign of vegetation upon them, nothing but sand piled upon sand. They form a belt 2 or 3 miles in width, and extend many miles in a northwest direction. Large water-holes are found at the base of the hills; large, deep, and contain most excellent water, cool, clear, and pleasant, and is permanent. A great deal of vegetable matter and young willow trees are found on their banks.

Westward to the Pecos, 22 miles, the first two miles was over the sand-hills, then a slightly rolling prairie, with a hard and sandy soil, covered with a thick growth of chaparral to the river. The Pecos is a rolling mass of red mud, with nothing to indicate its presence but a line of high reeds growing upon its banks. Along its banks are numerous lakes, the water of which is still more brackish than that of the river.

From the Nueces river northwest along the Pecos nearly to Horsehead crossing, and thence westward through the central part of the region to the mountains.[From the report of Capt. S. G. French; *Reconnaissance in New Mexico and Texas.*]

Leaving the Nueces the country becomes slightly hilly; the hills rise to a considerable elevation, are stony and barren, with limestone on the surface. The rich loamy soils are found only in the valleys. The valley at the head of Turkey creek is of large extent and fertile, and is covered with a large growth of mesquite. The banks of the creek are bordered with live and post oaks. Westward to the Las Moras the country is more rolling and more open. That stream flows over a bed of limestone, and trees line its banks as far as the eye can reach. To the Rio Grande the country is open, with only here and there a few mesquite trees, except along the streams. North of the Arroyo Pedro the soil becomes barren, and is covered with cactus and dwarf chaparral as far as the San Felipe, a stream shaded at its mouth with large groves of pecan, maple, elm, and mulberry trees. Thence the country rises northward to the San Pedro, where the table-lands of the plains are entered. Limestone forms the bed of this stream, while the valley is bordered by mountains, in which the limestone appears with horizontal strata. Thence to the Pecos the plain is traversed with valleys extending out from the streams, from which others branch off to the right and left, ramifying the country in every direction; and near the Pecos these valleys head in innumerable chasms and cañons, with rocky sides so high and steep as to form impassable barriers.

The Pecos is a remarkable stream, narrow and deep, extremely crooked in its course and rapid in its current; its waters are turbid and bitter, its banks are steep, and in the course of 240 miles there are but few places where an animal can approach them with safety. Not a tree or bush marks its course. Its average width is about 60 feet, and its depth 8 feet.

Leaving the Pecos, 30 miles south of Horsehead crossing, the road turns directly to the west up a wide valley or plain, with hills in broken ridges on both sides. As the distance increases the soil becomes more and more sterile, without grass, and yielding support to nothing but dwarf bushes, Spanish bayonets, and stunted cactus. For about 35 miles the country remains about the same to Comanche spring. The hills now gradually disappear, and the country becomes open. The soil is light, and, on being trodden up by the animals, was wafted by the strong wind over the plain, covering the bushes and grass for miles. Thence to the Sierra Diablo the road passes over a dreary and barren country, without timber or grass.

THE MOUNTAINOUS REGION.

Westward from the Pecos river to the Rio Grande the broad undulating plains continue, not continuously as on the east, but interrupted by several high and broken ranges of mountains, rising suddenly several thousand feet above the general surface. The plains, having widths of 20 or 30 miles between these mountains, are covered largely with mesquite bushes, cactus, and thorny chaparrals, and are interspersed with large salty depressions. Gramma grass occurs in localities, sometimes plentifully; but water suitable to drink is very scarce. The soil is usually very sandy and often covered with incrustations of salt. The area comprised in this region is about 19,500 square miles.

The Sierra Blanco mountains on the south, near the Rio Grande, is near the point of union of the Southern Pacific and Texas Pacific railroads, and is said to be the highest point in the state, the plains themselves being about 4,500 feet above the sea. Along the route of the former, northward to El Paso, wells have been sunk by the railroad company to a depth as great as 400 feet, and I have been informed by one of the engineers that the water even at that depth is too salty for use.

The following description of these mountains is taken from the report of Captain Marcy:

It appears that there are three distinct ranges of mountains traversing the country east of El Paso in a north and south direction from New Mexico into Texas; the first, the Organ range, 20 miles east of the Rio Grande; the Sacramento range, 30 miles east of this, the continuation of which, about 50 miles north of Doña Ana, is called the Sierra Blanco, and has perpetual snow upon its summit; the third, the Guadalupe, 50 miles east of the Sacramento range.

The Organ range takes its name from the supposed similarity of the high pointed peaks to the pipes of an organ. They are a trap formation, and somewhat columnar in structure, with the columns standing vertically, and in some cases rising to a height of 1,000 feet, and terminating in sharp points.

Captain French thus describes the country from Horsehead crossing westward to the Rio Grande across the central portion of the region (*Reconnaissance in New Mexico and Texas*):

Mountains rise on the right and left; the limestone formation has generally disappeared, and the hills wear a somber appearance from the dark rocks of the primitive formation. The country is beautiful; and the mountains, covered with green grass to their summits, present a pleasing appearance. The mountains of the Sierra Diablo do not form a single continuous ridge, but rise in irregular order, mountain on mountain and peak on peak, covering an immense extent of country, forming innumerable small shaded valleys, deep cañons, and ravines that wind in a circuitous course around their base. Columnar basaltic rocks that rise one behind the other to many feet in altitude form the sides of some of the cañons. But few places can present anything more lovely than Wild-Rose pass, surrounded as it appears to be by a wall of vertical rocks, rising a thousand feet in altitude, these rocks partly forming the sides of mountains that rise still higher and overlook the valley from every point. Northwestward other mountains appear of igneous origin, forming a lofty and continuous ridge, and presenting an extremely jagged and serrated crest. Near their tops forests of pine are visible. Westward to the mountains that border the Rio Grande the country is mostly an elevated plain, and also beyond these mountains to the river. The bottom lands of the river on the American side to the lower end of the island, a distance of 50 miles, are in many places very fertile. Timber is thinly scattered over the whole extent. The country around El Paso, excepting the bottom lands of the river, is sandy and covered with a dwarf growth of bushes.

ALLUVIAL OR RIVER LANDS.

The river lands form an important division in the agricultural features of the state, more from their richness, and consequent high productiveness, than from the area comprised by them. They are all but lightly timbered on the west of the central black prairie region, but thence to the coast the timber growth becomes larger, more dense, and of greater variety. The bottom lands also widen out toward the coast. The most important of the rivers described are the Red and the Brazos, and with the latter are the smaller streams, Oyster and Caney creeks, which are included in the region of its "sugar-bowl" or delta lands. These are looked upon as representing the highest type of fertility, and but for the malarial character of the densely timbered portions would be mostly under cultivation and more highly valued. The lands of the rivers are considered separately.

RED RIVER LANDS.—Red river forms in part the boundary between Texas and the Indian territory. Its course is eastward, for the most part across the head of the other large rivers of the state, until it passes into Louisiana. The following description of the upper portion of the river is made up of extracts from the report of Captain Pope:

Red river, rising among the cañons and bluffs of the Llano Estacado, has at first but little alluvial lands, but eastward through the gypsum region the valley widens out irregularly; the north fork has a sandy soil; the south fork a red loam; both streams having a growth of grass and some mesquite, etc. Along the immediate banks of the streams there is sometimes a timber growth of hackberry and very large cottonwood, principally the latter.

The gramma and mesquite grasses, which cover the entire surface, are short and early, growing very thickly and almost matted, and form a firm, spongy sod. They do not dry up and lose their strength and nutriment during the winter, as is the case with the grasses further east, but actually "cure" where they grow, like hay which has been prepared by the farmer.

The valley is 14 miles in width from the point at which the route of survey entered the first tributary to the crossing of the river at Preston.^a About four-fifths is covered with large timber, a few patches of prairie being found only sufficient to interrupt its continuity. The immediate valley of the river is about 100 feet below the gently ascending bluffs which border it, and is overgrown by timber of the largest size and best quality—oak, pecan, hickory, elm, etc.

The valley of the river between the thirty-second and thirty-fourth parallels of latitude (from San Antonio to Austin) is a thickly timbered region of fertile soil, well watered, and possessing a mild and healthy climate. It produces abundantly all the cereals, and is admirably adapted to the cultivation of cotton. The pasturage is very fine, and is only interrupted by the seasons for two or three months of the year.

Soon after leaving the plains the valley of the north fork of Red river assumes the terrace feature that is maintained eastward through the state. In the agricultural regions the terraces are known as the first and second bottoms. Captain Marey thus describes them as they appear in the gypsum formation:

The first terrace rises from 2 to 6 feet above the stream, is in places subject to inundation, and generally is from 50 to 200 yards wide. The second is from 10 to 20 feet high, is never submerged, and is from 200 to 1,500 yards wide. The third, which forms the high bluff bordering the valley of the river, is from 50 to 100 feet high, and bounds the prairie.

The following description of the river bottoms near the eastern limit of the red loam region is taken from the report of Lieutenant N. H. Michler:

The regular channel of the river at the ford is about 100 yards wide. There is at first a sand flat, the bed of the river in high water, with nothing upon it but large quantities of drift, and about one-fourth of a mile wide from the water's edge to the first bottom. The latter contains a rich alluvial soil, sand mixed with red clay, and timbered along the edge near the flat with young cottonwood and willows. This bottom bears evidence of being frequently overflowed. Then comes the second bottom, separated from the first generally by a steep bluff bank, the latter intersected by gullies and ravines, impassable at most places for wagons. High sand hills are found on the edge of this bottom. At the foot of the bluffs are fine springs and lakes, well timbered, and with good grass along them. This bottom is also subject to overflows. The width of the valley from bluff to bluff is about 14 miles, and the open prairie extends southward from their borders.

In the black prairie region the valley of the river is very narrow, the high limestone bluffs often approaching near the water's edge. In Cooke county these bluffs are 275 feet high, and are formed of the rotten limestone (Cretaceous) of the central prairie region. On the north side of the river, in the Indian Territory, the river lands are broader, and are partly under cultivation by whites; but to the west, on either side of the river, scarcely any cultivated lands are found. From the "lower cross timbers", in the eastern part of Cooke county, eastward to the Louisiana line, the bottom lands increase in width, and are among the richest in the state. They are heavily timbered with cottonwood, pecan, walnut, black oak, hackberry, mulberry, and white hickory, and have a dense undergrowth of cane.

Besides the low sandy overflowed lands, there are two general classes comprising the bottoms and occupying terraces above each other, viz: First bottom of red sandy or clayey land, and second bottom of dark or black loam, lying about 10 feet above the first and at the foot of the bluff or uplands. These two bottoms are peculiar only to those Texan rivers whose sources are in the region of the *Llano Estacado* on the northwest, viz, Colorado, Brazos, and Red rivers, as well as the Canadian, North Fork, and Arkansas rivers of the Indian territory. The soil characters mentioned by Michler continue down the river, the red sands and clays of the first bottom being derived from the red sandstones and red lands of the northwest region. This first bottom soil is of two varieties: a deep red sandy loam, overlying a red-clay subsoil, and a red waxy clay, with a subsoil of the same character. Both are highly productive, and subject to occasional overflow, being from 10 to 20 feet above low water. This red-land terrace is at first rather narrow, but becomes wider toward the eastern boundary of the state.

The black-loam terrace, about 10 feet above the first, is known as the second bottom, and is very level. Its soil is of a light and loose nature, rather silty, and darkened by the long accumulation of decayed vegetation. At the foot of the limestone bluff, in Grayson county, it is stiff and rather waxy, but this is a local feature only. The entire bottom of the river is from 1 to 2 miles in width, and, though comprising some of the finest lands of the state, a large proportion is still covered with its original timber growth. Cotton is one of the chief crops, growing from 4 to 6 feet in height, and yielding, under proper management, a bale of 500 pounds of lint per acre, even after many years' cultivation.

The following analyses show the composition of the soils of different parts of the valley:

No. 38. *Red clay soil* of the "first bottom", opposite Cooke county, taken 12 inches deep. Growth, cottonwood and hackberry.

No. 39. *Red waxy clay soil* of the first bottom from near the mouth of Kiamitia creek, opposite Lamar county, in the Choctaw nation, taken 12 inches deep. Growth, cottonwood, hackberry, etc.

No. 40. *Dark sandy loam soil* of the second bottom, at the same place as No. 39, depth taken 12 inches. Growth, ash and elm.

^a *Pacific Railroad Survey*, vol. II. Captain Pope was traveling eastward to Preston, a point on the river nearly north of Sherman, Texas.

Red river soils.

	NORTH OF COOKE COUNTY.		NORTH OF LAMAR COUNTY.	
	First bottom.		First bottom.	Second bottom.
	No. 38.		No. 39.	No. 40.
Insoluble matter.....	65.765	72.383	68.050	76.500
Soluble silica	6.618		9.863	9.100
Potash.....	0.405		0.345	0.404
Soda.....	0.030		0.066	0.089
Lime.....	2.933		1.116	0.466
Magnesia.....	2.623		1.217	0.619
Brown oxide of manganese.....	0.085		0.126	0.160
Peroxide of iron.....	4.681		5.274	3.286
Alumina.....	8.361		8.367	3.246
Phosphoric acid.....	0.156		0.209	0.163
Sulphuric acid.....	0.020		0.030	0.077
Carbonic acid.....	1.707		0.952	
Water and organic matter.....	6.898		4.906	5.758
Total.....	100.382		100.521	99.947
Available inorganic.....			1.450	0.732
Available phosphoric acid.....			0.051	0.056
Humus.....			0.882	1.099
Hygroscopic moisture.....	9.882		9.566	6.777
absorbed at.....	28 C.°		28 C.°	27 C.°

In the above analyses the percentage of potash is adequate for high fertility. There is a fair proportion of phosphoric acid, with an amount of lime more than sufficient for full thriftiness. In the three soils the differences lie chiefly in the lime and magnesia, which in the first bottom exist as carbonates, and are rather excessive in quantity, and in the fact that the second bottom soils are more sandy. These analyses corroborate the statements that the valley lands of Red river yield yearly an average of a bale (1,500 pounds of seed-cotton) per acre.

SABINE RIVER LANDS.—The bottom lands of Sabine river, from its headwaters as far east as Cass county, are of a dark and heavy waxy nature, quite wide and well-timbered, but subject to overflow, and are not under cultivation. Thence to its mouth this waxy feature is destroyed by the intermixture of sand, a dark sandy loam covering the wide undulating bottoms, which are here above overflow, and are timbered with post oak and short-leaf pine. Cotton is largely planted on these lands (except in the extreme southern counties), grows to a height of from 5 to 7 feet, and yields, it is claimed, 1,500 pounds of seed-cotton per acre.

TRINITY RIVER LANDS.—The extreme headwaters of the Trinity river are in Jack county, but a short distance west of the central black prairie region. The lands of the river bottoms are therefore derived chiefly from the sandy uplands adjoining the streams, and are of a dark loamy or silty character until near the eastern limit of the black prairies, from which point southward there is a thick deposit of black waxy clay over the silt. The bottoms of the upper division of the river are well timbered with oak, elm, pecan, black walnut, bois d'arc (known also as Osage orange), honey-locust, hackberry, and cottonwood.

The lands are rich, as shown by the analysis of a sample as given in the table on page 44, but are not very generally under cultivation, being more or less subject to overflow. They are said to produce in ordinary seasons 1,000 pounds of seed-cotton per acre.

In this part of the state there are broad prairie valley lands on either side of the Trinity bottom several miles in width, bounded by the high bluffs of rotten limestone. At the foot of the ridges the soil is usually stiff and waxy, but becomes more and more sandy toward the river, with heavy beds of sand in some places. The valley lies beautifully for agricultural purposes, is gently undulating, and is apparently easy of cultivation. A growth of mesquite occurs occasionally on the prairie. Very little of the valley is in actual cultivation.

The bottoms of the middle and southern portions of the river have widths varying from 1 to 5 miles, and are heavily timbered with red, burr, and pin oaks, pecan, ash, and cottonwood, with cypress on the south.

The lands immediately adjoining the river are light and silty in character, but further back they are a heavy and waxy black clay, several feet in depth, and are underlaid usually by sand. They are very difficult to till in wet weather, and produce excellent crops of corn, cotton, and sugar-cane. Cotton grows 6 or 8 feet high, and, it is claimed, produces from 1,500 to 2,000 pounds of seed-cotton per acre.

The following analysis gives the composition of the valley land of the upper part of the Trinity:

No. 25. *Dark sandy loam* from 2 miles west of Dallas, in Dallas county, taken 10 inches deep. Timber growth, oak, elm, and hickory.

COTTON PRODUCTION IN TEXAS.

Trinity river valley soil, Dallas county.

	No. 25.
Insoluble matter.....	88.065
Soluble silica.....	16.553
Potash.....	0.509
Soda.....	0.225
Lime.....	16.844
Magnesia.....	1.602
Brown oxide of manganese.....	0.054
Peroxide of iron.....	3.857
Alumina.....	5.205
Phosphoric acid.....	0.152
Sulphuric acid.....	0.158
Carbonic acid.....	12.008
Water and organic matter.....	6.270
Total.....	99.002
Hygroscopic moisture.....	10.630
absorbed at.....	14 C. ^o

The prominent feature of this soil is the very large percentage of carbonate of lime, the latter from the adjoining hills of rotten limestone. There is a considerable percentage of potash and a fair amount of phosphoric acid, which, in presence of so much lime, is readily available, and makes the soil highly productive.

BRAZOS RIVER LANDS.—The lands of the Brazos river are considered the best and most valuable in the state, and are the most extensive of the river lands. The source of the river is at the foot of the Llano Estacado, and for a distance of 300 or 400 miles the river cuts its way among the gypsum beds, sandstones, and limestones of the northwestern region, carrying down with its waters the red sands and clays which go to form the first bottom lands along its entire course to the coast.

The bottom lands, before the river enters the black prairie region, are rather narrow, the bluffs often coming to the bank of the stream. They are not generally heavily timbered, mesquite trees being the prevailing growth in many places. The soil is a red sandy loam, except near the gypsum beds, where it is said to be whitish in color. The water of the river in this northwest region is somewhat salty, and salt incrustations are frequently found on some of the rocks in the streams.

VALLEY OF THE BRAZOS.—Separated by a very gentle dividing ridge, we find the valley of the Brazos extending 150 miles westward to the summit between its waters and those of the Colorado. It is in all respects similar in character and natural features to the valley of the Trinity, but rather more heavily timbered to a point near the head of the Clear fork.

The gently rolling country east and west dips with a gradual slope, in most cases of about 50 feet, to the immediate bottom lands along the river, which do not exceed a mile in width.

As we proceed to the west from the Clear fork, the oak and ash timber become much scarcer, until near the last tributary of the Double Mountain fork of the river we lose it entirely. It is then replaced by dense groves of large mesquite, which cover at least two-thirds of the country to a point a few miles east of the dividing ridge of the waters of the Brazos and those of the Colorado.

The country drained by the Brazos and its tributaries is more uneven in its surface and more densely timbered than either the Trinity to the east or the Colorado to the west, and with a climate in all respects delightful; it is a very fertile region, eminently adapted to agricultural purposes.—*Captain Pope.*

The bottom lands of the river, after leaving this region, may for description be conveniently divided into two sections, the first extending to Richmond, in Fort Bend county, the second thence to the coast, and known as "the sugar-bowl".

The bottoms of the first division have a width of from one-half to 2 miles, and are covered with a heavy timber growth of cottonwood, poplar, black walnut, pecan, and elm, and a dense undergrowth of cane, etc. The soil of the first bottom is a red alluvial loam, quite deep, overlying a red clay. At 30 feet a bed of "white and round quartz pebbles" occurs. That of the second bottom is usually a dark sandy loam.

In some of the counties the red lands of the first bottom are most prominent and extensive, but both seem to be equally productive, and are considered the best cotton lands of the state. A large proportion of these bottoms is under cultivation, but their unhealthfulness hinders their settlement. Cotton grows to a height of from 6 to 8 feet, yielding about a bale of lint or 1,500 pounds of seed-cotton per acre. Corn also is very productive, yielding, it is claimed, as much as 40 or 60 bushels per acre.

BRAZOS DELTA, OR "THE SUGAR-BOWL."—The lower division of these alluvial lands is the sugar-producing region of the state. It covers an area of about 900 square miles, and embraces, besides the lands of the Brazos, those of Oyster and San Bernard creeks on either side.

The region is perfectly level, heavily timbered, has a dense undergrowth, and lies from 20 to 30 feet above the common water-level of the river.

The soils of the region present three different varieties, viz, the red alluvial loam, immediately adjoining the river and the two creeks; ash and elm flats lying next to this, and finally the black wild peach lands.

The red-loam lands are considered the best, because of their excellent drainage, easy tillage, and great fertility. They occur in belts from one-half to a mile in width, or in bodies containing from 100 to 1,000 acres each. They have a depth of about 30 feet, the color of the soil changing somewhat at 18 inches.

Canebrakes cover the land, the timber growth being cottonwood, ash, elm, pecan, sycamore, hackberry, and a variety of oaks. Cotton grows to a height of from 5 to 10 feet, and yields about 2,000 pounds of seed-cotton per acre, both when fresh and after fifty years' cultivation.

The ash and elm lands have a stiff black soil, and are 18 inches deep, with a dark subsoil not so stiff. The timber growth is principally elm and ash. The lands are flat and poorly drained, and do not seem to be much under cultivation, though producing, it is claimed, as much as 1,500 pounds of seed-cotton per acre.

The black peach lands, while black in color, are sandy in character, and occur interspersed in small areas. They have a soil 18 inches in depth, and a lighter subsoil, and are easily tilled and best adapted to sugar-cane. They have a growth of wild peach, pecan, live oak, and hackberry, and are in part prairie. Cotton grows very high on these lands, and it is claimed will produce as much as 2,500 pounds of seed-cotton per acre.

Sugar is the chief production of the sugar-bowl region, the yield upon 5,340 acres for the year 1879, according to the census returns, being 4,443 hogsheads, with 355,573 gallons of molasses. The average yield per acre was eight-tenths of one hogshead of sugar and 66.5 gallons of molasses.

The following analyses show the composition of the various soils of the Brazos bottom, and are taken from different sections:

No. 19. *Brazos river red soil* from Granbury, Hood county, taken 12 inches deep. Timber growth, live and post oaks, pecan, and sumac.

No. 20. *Red clay subsoil* of the above, taken from 12 to 20 inches.

No. 18. *Brazos bottom red-loam soil* from 4 miles west of Hearne, Robertson county, taken 10 inches deep. Timber growth, pin oak, ash, walnut, and pecan.

No. 29. *Oyster creek red soil*, Brazoria county, taken 12 inches deep. Timber growth, live and other oaks, elm, ash, hackberry, pecan, etc. Cane undergrowth.

No. 32. *Black peach soil* of San Bernard river, near Columbia, Brazoria county. Depth taken, 12 inches, by David Nation, of Columbia; timber growth, pecan, live oak, hackberry, mulberry, and wild peach.

Brazos river bottom land.

	UPPER VALLEY LAND.				BRAZOS DELTA, OR SUGAR-BOWL.	
	HOOD COUNTY.		ROBERTSON COUNTY.		BRAZORIA COUNTY.	
	Brazos river second bottom.		Brazos bottom.		Oyster creek.	San Bernard river.
	Red soil.	Subsoil.	Red soil.		Red soil.	Black peach soil.
	No. 19.	No. 20.	No. 18.		No. 29.	No. 32.
Insoluble matter.....	88.177 } 90.328	75.570 } 80.068	69.391 } 80.682		66.461 } 80.411	80.800 } 87.009
Soluble silica.....	2.151 }	4.498 }	11.291 }		13.950 }	6.203 }
Potash.....	0.298	0.582	0.258		0.781	0.441
Soda.....	0.081	0.217	0.084		0.226	0.055
Lime.....	0.413	0.326	2.050		1.876	0.596
Magnesia.....	0.343	0.099	0.004		1.907	0.007
Brown oxide of manganese.....	0.040	0.010	0.109		0.013	0.000
Peroxide of iron.....	2.076	3.873	3.454		3.697	2.179
Alumina.....	2.508	10.589	3.589		4.020	3.685
Phosphoric acid.....	0.094	0.109	0.370		0.148	0.055
Sulphuric acid.....	0.020	0.056	0.290		0.034	0.030
Carbonic acid.....			1.047		1.961	
Water and organic matter.....	2.735	3.076	6.800		4.042	5.748
Total.....	98.936	100.155	99.337		99.116	100.504
Available inorganic.....			0.740		0.585	1.226
Available phosphoric acid.....			0.035		0.034	0.055
Humus.....			1.016		0.714	2.658
Hygroscopic moisture.....	6.026	11.219	8.835		8.420	6.980
absorbed at.....	12 C.°	10 C.°	10 C.°		12 C.°	13 C.°

In the soil and subsoil from Hood county the most prominent feature developed by the analyses is the low percentage of phosphoric acid, a minimum quantity. It is, however, made available by the abundance of lime present. The percentage of potash is large in the subsoil, and in sufficient quantity in the soil for thrifty land.

In the sample from Robertson county a much larger amount of lime is present, derived probably from the rotten limestone through which the river and its tributaries have cut their way. The percentage of phosphoric acid also is extraordinarily high, with a fair amount of potash, thus making the alluvial land of the river in this place much richer than in Hood county. This increased fertility is also seen in the higher yield of cotton per acre.

The lands of the sugar-bowl of the Brazos alluvial are noted for their fertility, yielding usually from 1 500 to 2,000 pounds of seed-cotton per acre. In the above analyses the soil from Oyster creek is richer in mineral ingredients than that from the San Bernard river, containing larger percentages of potash, lime, and phosphoric acid, and resembles very much the red lands of the Brazos river.

The black peach land contains a larger amount of humus, and it will be seen that all of the phosphoric acid in the soil is available.

COLORADO RIVER LANDS.—The sources of the Colorado and of its western tributary, the Concho, are among the western hills and broad plains and table-lands of the Llano Estacado. For a distance of several hundred miles its waters flow among the sandstones and limestones of the western region with an easterly course to the black prairie region, then turn southward along its border to the lower edge of Burnet county, and thence east-southeast to the coast.

The bottom lands of the river, from its source to the black prairie region, are narrow, with many and frequent high bluffs near the stream.

COLORADO VALLEY.—Passing the dividing ridge of Brazos, we descend upon the tributaries of the Colorado, about 27 miles from the main stream. This valley, from the summit of the dividing ridge to the eastern base of the Llano Estacado, is about 67 miles in width, and is intersected in that distance by many small running streams tributary to the Colorado, and from 2 to 6 miles apart. The east side of the valley is about equally divided into prairie and forests of mesquite timber, and is much less undulating in surface than the country to the east. The mesquite becomes less abundant on the west side of the river, probably not occupying more than one-fourth of the country, until at the base of the Staked Plain it disappears altogether. The soil of the valley of the Colorado is good, but less moist and fertile than that of the valley of the Brazos. The rain is not so abundant as in the valleys of the streams to the east, but falls in sufficient quantity to obviate the necessity of irrigation, as was sufficiently evinced in the fact that although we traversed it at the very driest season of the year most of the small tributaries of the river were running streams, and few were without water. The Colorado itself was about 40 feet in width, and with a rapid current traversed its valley from side to side in a very tortuous course. The low and gently sloping ridges on each side were faced with red sandstone, and the soil was a rich red loam, which, although light, was very fertile. Limestone and other building material, with the exception of timber large enough for joists and planking, are readily obtained at any point of the valley, and its agricultural features, although not so eminently favorable as those of the country to the east, are nevertheless good. The mesquite, a hard and durable wood, grows in extensive forests, is about 30 feet high and from 4 to 10 inches in diameter.—*Captain Pope.*

On entering the more level lands of the prairies the bottom lands become wider, and thence to the coast have widths varying from one-half to a mile or more. This includes the valley or second bottom lands, the first, or bottoms proper, being narrow and more or less subject to overflow in high-water seasons. The bottoms have a large timber growth of white and pin oaks, elm, ash, cottonwood, sycamore, pecan, and hackberry, with usually a dense undergrowth of cane, etc. The lands are for the most part a reddish loam or silt several feet in depth, underlaid by clay. Near the uplands on either side the lands are darker, and in the black prairie region stiffer and more clayey in character. South of Columbus, in Colorado county, they resemble the lands of the sugar-bowl or Brazos alluvium, and properly belong to it. Cotton is the chief crop on the bottom lands of the river, the stalk growing from 5 to 7 feet high, and yielding from 1,500 to 2,000 pounds of seed-cotton per acre.

SAN SABA RIVER LANDS.—The lands of the San Saba river, a tributary of the Colorado, comprise narrow and timbered bottoms along the banks of the stream, mesquite valleys, with both red gravelly soils and black loamy and clayey soils, reaching back to the hills. These valleys afford the chief farming lands of that section. (See description of San Saba county.)

GUADALUPE RIVER LANDS.—The bottom lands of the Guadalupe river are not very extensive or wide, and have a timber growth of cottonwood, pecan, ash, oaks, mulberry, and hackberry, with a variety of undergrowth. The soil is mostly a sandy loam from 10 to 15 inches deep; the subsoil a yellow clay, sometimes jointed in character. The valley lands are in some places broad and open, with a mesquite growth and a dark calcareous soil. Cotton grows from 5 to 7 feet high, and yields about 1,500 pounds of seed-cotton per acre.

SAN ANTONIO RIVER LANDS.—The bottom lands of the San Antonio river are narrow and unimportant. Its valleys have in some counties a width of $1\frac{1}{2}$ miles and a growth (in Wilson county) of elm, hackberry, pecan, ash, and mesquite. In the counties near the coast the river flows between high banks of white clay-stone, or adobe, along which there is usually a growth of pecan trees and mesquite.

NUECES RIVER LANDS.—The Neuces river is mainly confined to the thinly inhabited southwestern section of the state. In San Patricio county its bottoms have a growth of live oak, cottonwood, ash, elm, hackberry, and willow, and a black alluvial soil. Its valley lands seem to be preferred; they have a growth of mesquite and "wesatche", and a light sandy soil, which is easily tilled.

RIO GRANDE RIVER LANDS.—The bottom and valley lands of the Rio Grande river from its headwaters southward to Edinburg, Hidalgo county, are narrow, and, so far as known, are unimportant, the hills of the uplands coming to the

river banks very often. From Edinburg to the mouth of the river these lands widen out rapidly, and embrace those of the Sal Colorado, which stream is said to be but an outlet of the Rio Grande in high water, and runs off almost at right angles to it.

The entrance to the mouth of the Rio Grande is over a bar of soft mud varying from 4 to 6 feet deep, and the river within a few hundred yards of its mouth is not more than 1,000 feet wide. The shore-line of the coast, scarcely broken by the action of the river, is formed of a series of low shifting sand-hills, with a scanty herbage. Inside these hills are numerous salt marshes and lagoons, separated by low belts of calcareous clay, but a few feet above the sea, and subject to overflow. The first high land is 10 miles from the mouth.

Northward to Brownsville the lands on each side of the river are level and covered with a dense growth of mesquite. The margin of the river, which is exposed to overflow, abounds in reed, canebrake, palmetto, willow, and water plants.—*Mex. Bound. Survey*, vol. I.

The valley from Brownsville northward has a width of 50 miles. The following information is from Rev. J. G. Hall, of Brownsville:

The growth of these lands is mesquite and ebony, though there are many other scrubby varieties. In many places, too, the undergrowth is very heavy, forming chaparrals. For the first 50 or 60 miles up the river the valley loses itself in the plain; farther up it becomes narrower, until at little over 100 miles it becomes almost nothing. The land along the lower river is in belts of black waxy and of sandy soils, both being very fertile, but the former more so than the latter. Neither has a clay subsoil. With rains these lands are wonderfully productive, and now that the border has been comparatively quiet for some years the agricultural interests are rapidly advancing. These belts of land are sometimes 8 or 10 miles wide and sometimes 2 or 3 miles. The timber is not very heavy anywhere, but is heaviest along the river.

Up to this time there has been very little cotton planted, but the people are beginning to turn their attention more to its cultivation.

The following analyses are given to show the composition of the valley lands of two of these rivers:

No. 22. *Colorado river valley loam soil* from Bastrop, Bastrop county, taken 10 inches deep. No growth where taken.

No. 23. *Colorado valley loam soil* from 4 miles east of Austin, Travis county, taken 10 inches deep. Timber growth, pecan, elm, oak, and hackberry.

No. 24. *Soil* taken 8 inches deep from a field near the above that has been under cultivation more than forty years.

No. 28. *San Saba river red valley soil* from north of San Saba, San Saba county, taken 10 inches deep. Timber growth, mostly mesquite.

No. 37. *Rio Grande valley soil* from near Brownsville, taken 12 inches deep, and sent by Rev. J. G. Hall. Growth, mesquite and ebony.

River valley lands.

	COLORADO RIVER VALLEY.			SAN SABA RIVER.	RIO GRANDE VALLEY.
	BASTROP COUNTY.	TRAVIS COUNTY.		SAN SABA COUNTY.	CAMERON COUNTY.
	Soil.	Soil.	Cultivated soil.	Red loam soil.	Dark loam soil.
	No. 22.	No. 23.	No. 24.	No. 28.	No. 37.
Insoluble matter.....	71.082 } 83.357	62.906 } 72.663	87.088 } 91.742	77.017 } 82.164	36.041 } 53.296
Soluble silica.....	12.275	10.957	4.654	4.547	17.255
Potash.....	0.444	0.581	0.393	0.507	1.308
Soda.....	0.168	0.118	0.077	0.107	0.218
Lime.....	0.675	7.793	0.459	3.971	14.433
Magnesia.....	0.090	1.379	0.447	0.990	1.582
Brown oxide of manganese.....	0.153	0.120	0.108	0.078	0.069
Peroxide of iron.....	3.058	2.934	2.068	2.940	4.085
Alumina.....	0.291	3.283	2.042	2.635	9.114
Phosphoric acid.....	0.258	0.207	0.086	0.281	0.204
Sulphuric acid.....	0.208	0.033	0.026	0.007	0.041
Carbonic acid.....		5.075	Trace.	2.350	9.912
Water and organic matter.....	5.028	5.026	2.376	4.412	6.008
Total.....	99.730	99.225	99.824	100.637	100.220
Available inorganic.....		1.579			1.465
Available phosphoric acid.....		0.041			0.951
Humus.....		1.688			
Hygroscopic moisture.....	9.164	7.570	3.700	7.230	13.754
absorbed at.....	14 C.°	10 C.°	18 C.°	13 C.°	12 C.°

These soils show large percentages of potash, with a sufficiency of lime for the large amounts of phosphoric acid that are present. There is a comparatively large amount of humus in the Travis county soil.

The analysis of the cultivated soil is instructive in showing large reductions in all of the essential ingredients, viz, potash, lime, magnesia, phosphoric acid, and organic matter. It is evident that the addition of phosphate manures to this land will soon be necessary to maintain its fertility.

The soil of San Saba river valley is rich in all of the elements necessary to fertility and durability, viz, potash, phosphoric acid, and lime. It is light and sandy, and yields abundant crops.

The soil of the Rio Grande valley contains an extraordinary percentage of potash, a large amount of phosphoric acid, and a very large amount of carbonate of lime. The percentage of humus is also great, and the soil has a large retentive power for moisture. Altogether, this soil, which is easily tilled, seems to be nearer what may be thought to be a "perfect soil" than any other in the state.

The following description by Captain Pope (a) regarding the valley lands of the Rio Grande from El Paso southward is given at length, because of the little that is generally known concerning a region in which these valleys offer almost the only tillable lands:

VALLEY OF THE RIO GRANDE.—At Frontera, about 5 miles above El Paso, the Rio Grande commences to make its passage through the chain of mountains which intersect its course, and to a point immediately in the neighborhood of Molino it is bordered closely on both sides by a range of high and rugged mountains. At Frontera, four miles above, the range on the west side subsides into the vast level table-lands which extend, with little interruption, many miles to the westward; but on the east side the mountains gradually depart from the river, becoming more rugged and lofty, until they unite on the "Jornada del Muerto" with the continuous ridges of the Rocky mountains. The river cuts through them between Frontera and Molino by a succession of rapids, and at one place by a perpendicular fall of 2 or 3 feet, and this passage has, from the period of its discovery by the Spaniards, been known as El Paso. The Mexican town of that name is about 2 miles below the debouchure of the river from the mountains. With the exception of the limited strip between Frontera and Molino, the immediate valley of the Rio Grande is from 2 to 5 miles in width and perfectly level, and the river traverses it from side to side in many sinuosities. These level bottom lands can be readily irrigated from the river, and possess a soil which, although not deep, and containing rather too large a proportion of sand for the notions of farmers in the United States, is nevertheless extremely fertile, and well adapted to the production of all the cereal grains.

The system of irrigation renews the fertility of the soil by spreading over it every year a fat deposit several inches in thickness, which is brought down in suspension by the river, and to this deposit is undoubtedly due the fact that the Mexicans for so many successive years have been able to continue the same crops upon the land. The soil is only about 4 or 5 inches deep, and for cultivating it the Mexican implements have been conclusively shown, by experience of several years, to be the best. The wooden plow which they use barely enters the earth sufficiently to turn up 3 or 4 inches in depth, and they thus never pass below the yearly deposits of the river. The iron plow, on the contrary, passes several inches below this, and turns up a soil more than four-fifths of which is sand, and consequently of little productiveness. As an evidence of the results, it will suffice to say that of two fields of the same size contiguous to each other and identical in soil, the one cultivated with great care by the government, after the American fashion, the other the property of an old Mexican, who cultivated it himself without assistance, the products were little or nothing for the first and a crop averaging from 30 to 40 bushels of corn to the acre for the last. The immediate valley of the river between Dona Ana and Frontera contains about 128,000 acres of arable land.

The most valuable feature, however, of the valley of the Rio Grande is yet but partially developed; and as it ministers to the luxuries rather than to the necessities of life, it cannot, in the absence of demand for such things, occupy a very important place in the present wealth of New Mexico. I refer to the peculiar adaptation of the valley to the culture of the grape. The east side of the Rio Grande is faced by chains of lofty mountains at an average distance from the river of 15 miles, which, at San Felipe at the north and El Paso at the south, impinge directly upon the banks. A semicircular sweep of country is thus inclosed from the northern and eastern winds, and in consequence we find within it a very mild and equable climate, little subjected to the change of the seasons. The river having a general course to the southeast, and the ranges of mountains on the east side being nearly parallel to it, the whole of this area has a southern and western exposure, and, with a soil sufficiently fertile and of great warmth, it is most wonderfully adapted to the culture of the grape.

SURVEYS AND MEASUREMENTS IN TEXAS.—The system of surveying lands is not that common in other western states, viz, that of dividing it into townships, sections, and numbered subdivisions; but the Spanish land measure in use when the state was a separate republic, and in which the original land grants were expressed, is the legal measure. The divisions are varas, labors, and leagues, and distances are at present given in linear varas, instead of in chains and feet.

Spanish land measure.

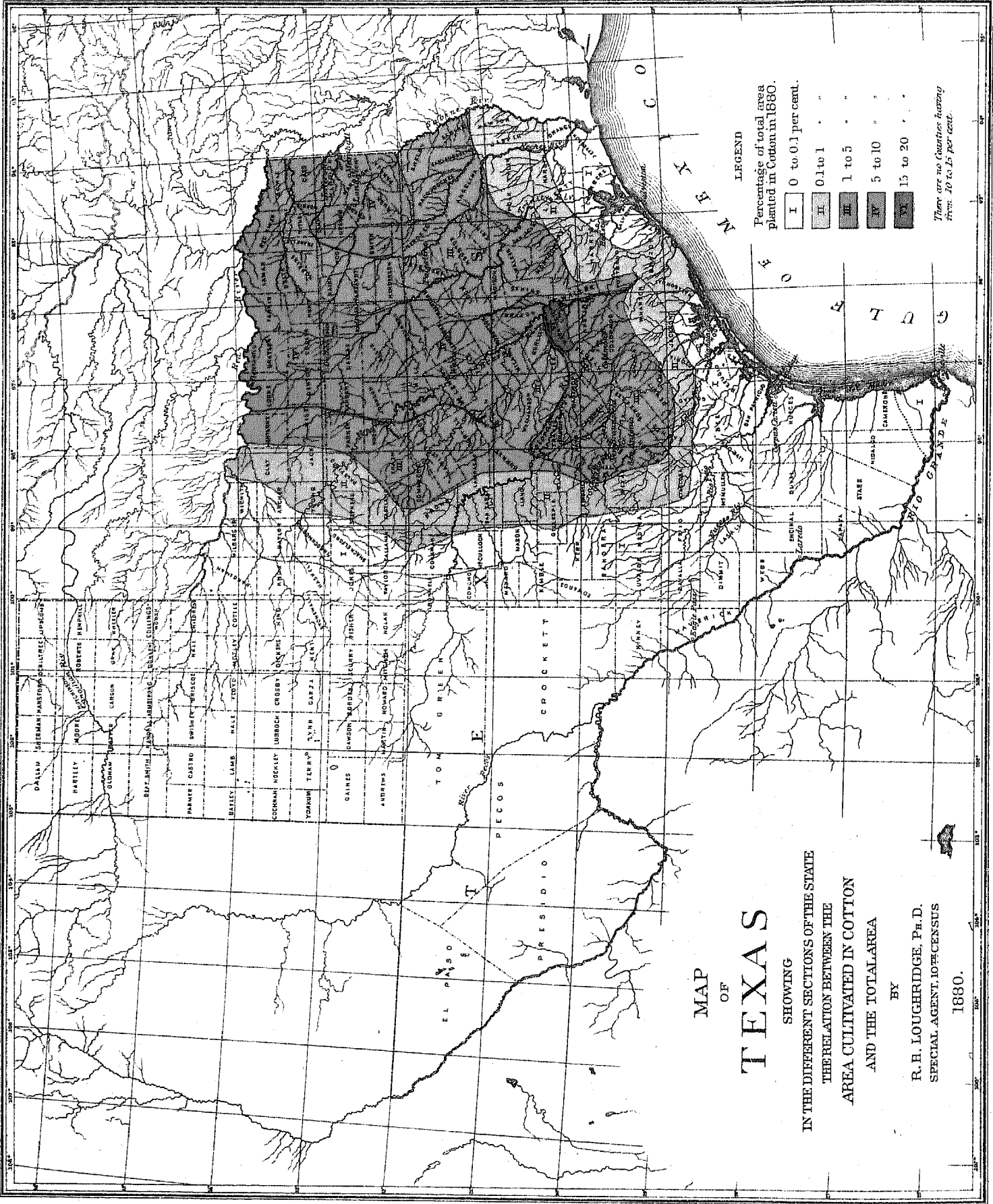
1 vara.....	33 $\frac{1}{4}$ inches.
1 acre.....	5,646 square varas = 4,840 square yards.
1 labor.....	1,000,000 square varas = 177 acres.
$\frac{1}{2}$ league.....	8,333,333 square varas = 1,476 acres.
1 league.....	25,000,000 square varas = 4,428 acres.
1 league and labor.....	26,000,000 square varas = 4,605 acres.

To find the number of acres in a given number of square varas, divide by 5,646—fractions rejected.

REMARKS ON COTTON PRODUCTION IN TEXAS.

In Thrall's *History of Texas* it is stated that cotton-seed was brought to the Brazos river in Texas in 1821 by Colonel Jared E. Grace, one of the earliest settlers, and that in 1825 he erected the first cotton-gin in the state. The next year the Austins built one on the west side of the Brazos about 10 miles north of Columbia. This was subsequently burned, and the place has been known as the Burnt Gin place. About the same time another gin was built on Old Caney, in Matagorda county. The staple at that time was packed in bales of 50 and 100 pounds weight and transported to the Rio Grande on mules, 250 pounds constituting a mule-load. In 1831 Edwin Waller sent a schooner-load of cotton from the mouth of the Brazos to Matamoras, and sold it for 62 $\frac{1}{2}$ cents per pound.

a Report to Captain A. A. Humphreys, in charge of the office of explorations and surveys, on "artesian well experiments".



MAP OF TEXAS

SHOWING
IN THE DIFFERENT SECTIONS OF THE STATE
THE RELATION BETWEEN THE
AREA CULTIVATED IN COTTON
AND THE TOTAL AREA

BY
R. H. LOUGHRIDGE, P. H. D.
SPECIAL AGENT, 10TH CENSUS
1880.

LEGEND

Percentage of total area
planted in cotton in 1880.

I	0 to 0.1 per cent.
II	0.1 to 1
III	1 to 5
IV	5 to 10
V	15 to 20

There are no counties having
from 10 to 15 per cent.

In 1834 the cotton crop was estimated to be worth \$600,000.

In 1848 the crop amounted to 39,774 bales of 500 pounds weight, and in successive census years, according to the returns, as follows: In 1850, 58,072 bales; in 1860, 431,463; and in 1870, 350,628 bales. For the census year 1880 the returns show 805,284 bales, an increase of 454,656 since 1870, or more than double the production of that year, the state ranking as third in cotton product, raising 13.7 per cent. of the entire crop of the country.

Area.—In 1869 the region of cotton cultivation extended nearly half-way across the state from east to west, and embraced in its limits about 108,000 square miles, or about 41 per cent. of the land area. A line marking its western limit would pass southward from Red river, through the counties of Montague, Wise, Parker, Erath, and Hamilton, to Atascosa, and thence eastward to Matagorda county.

A line marking the limit for 1879 would pass from Red river, in Wichita county, southwest into Jones and Taylor, and south through Coleman, McCulloch, Mason, Kerr, Bandera, and Uvalde to the Nueces river, which it would follow nearly to the Gulf, thence turning northwest to the northwest corner of Calhoun county. Small spots of cotton production (49 acres altogether) occur also on the Rio Grande in Cameron and Hidalgo counties. The entire region of production includes an area of about 126,000 square miles, or not one-half of the land area of the state, and extends nearly 100 miles farther west and embraces 18,430 square miles more than in 1869.

The building of the new lines of railroad westward will probably be instrumental in extending the region of cotton production to the Llano Estacado long before the census year of 1890.

Taking the combined area of what may be termed the agricultural portion of Texas, viz, the oak, hickory, and pine region, the central black prairies, the northwest red-loam lands, and a part of the coast prairies, we find it to be in round numbers about 102,000 square miles, or 65,280,000 acres.

Texas is chiefly a corn-producing state, that crop occupying 2,468,587 acres, or 32 per cent. of the lands under cultivation, and exceeding the area of cotton by 130,017 acres. The number of bushels of corn produced was 29,065,172, the average production for the state being, for 1879, 11.7 bushels per acre. Cotton is the second crop of the state as regards acreage (2,178,435), wheat being third (373,570 acres), their percentages of tilled lands being respectively 28.5 and 4.8.

Of the organized counties, one hundred and thirty-nine report their acreages of corn to be greater than that of any other crop; twenty-eight counties produce no cotton at all, but are chiefly devoted to stock-raising, leaving one hundred and forty-two that may be called cotton counties.

By reference to the tables at the beginning of this report, it will be seen that in thirty-one counties alone does the cotton acreage exceed that of corn. These are embraced mostly in the central part of the state northward from Washington and Fayette counties, and include the following: Cass, Camp, Marion, Gregg, Harrison, Panola, Smith, Navarro, Limestone, Freestone, Robertson, Walker, Grimes, Brazos, Burleson, Milam, Lee, Bastrop, Kaufman, Dallas, Johnson, Ellis, Hill, McLennan, Falls, Caldwell, San Jacinto, Washington, Austin, Fayette, and Colorado.

Thirty-four counties of the state have one-third or more of their tilled lands in cotton; in eleven of these the percentage is over 40. Marion county ranks highest, the percentage being 46.2 of the tilled lands; Grimes and Brazos follow with 45 and 45.4 per cent.

TABLE III.—SHOWING POPULATION AND COTTON PRODUCTION IN EACH AGRICULTURAL REGION OF THE STATE.

Agricultural regions.	Area.	POPULATION.			COTTON PRODUCTION.										
		Total.	White.	Color'd.	Acres.	Bales.	Average per acre.				Total in tons.		Percentage of the state's total production.	Cotton acreage per square mile.	Bales per square mile.
							Fraction of bale (500 lbs.).	Seed-cotton.	Lint.	Seed.	Lint.	Seed.			
	<i>Sq. mls.</i>						<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>						
Total for the State.....	262,200	1,561,740	1,197,237	364,512	2,178,435	805,284	0.37	555	185	370	201,321	402,642	100.0	17.2	6.4
Red River alluvial.....	4,710	118,901	98,615	25,340	169,432	91,802	0.54	810	270	540	22,951	45,902	11.4	36.0	19.5
Oak, hickory, and pine uplands.....	81,490	511,212	320,881	190,331	914,305	325,654	0.36	540	180	360	81,414	162,828	40.4	29.0	10.3
Long-leaf pine.....	5,140	25,770	17,090	8,080	17,567	7,262	0.41	615	205	410	1,516	3,032	0.9	3.4	1.4
Central black prairie.....	88,440	514,257	452,179	62,078	744,685	249,893	0.34	510	170	340	62,473	124,946	31.0	22.3	7.5
Northwestern red-loam prairie.....	19,920	82,307	80,924	1,383	40,301	10,931	0.24	360	120	240	2,732	5,464	1.4	2.3	0.5
Southern and coast prairie.....	23,030	230,559	140,219	84,840	264,253	106,013	0.40	600	200	400	26,653	53,306	13.3	11.5	4.6
Brazos alluvial, or sugar-bowl.....	9,350	23,703	5,038	18,665	21,838	13,097	0.60	900	300	600	3,274	6,548	1.6	6.5	3.9
Rio Grande valley.....	5,850	19,306	19,075	281	49	32	0.65	975	325	650	8	16	-----	-----	-----
Other counties.....	135,860	65,674	62,216	3,458	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

TABLE IV.—SHOWING "BANNER COUNTIES" AS REGARDS PRODUCTION AND PRODUCT PER ACRE IN THE VARIOUS AGRICULTURAL REGIONS OF THE STATE.

REGIONS ACCORDING TO PRODUCT PER ACRE.		COUNTY IN EACH REGION HAVING HIGHEST TOTAL PRODUCTION.					COUNTY IN EACH REGION HAVING HIGHEST PRODUCT PER ACRE.					
Name.	Average product per acre, fraction of a bale.	Name.	Rank in product per acre in the state.	Cotton acreage.	Total production (bales.)	Product per acre, fraction of bale.	Name.	Rank in total production in the state.	Cotton acreage.	Total production (bales.)	Product per acre.	Rank in product per acre in the state.
Rio Grande valley	0.65	Cameron.....	1	25	23	0.92	Cameron.....	133	25	23	0.92	1
Brazos alluvial, or sugar-bowl	0.60	Fort Bend	7	10,873	6,431	0.59	Brazoria.....	72	5,402	3,484	0.64	4
Red River alluvial	0.54	Lamar	6	40,390	24,623	0.61	Bowie	41	11,599	7,958	0.69	2
Long-leaf pine	0.41	Tyler	28	5,504	2,543	0.46	Liberty.....	91	3,768	1,852	0.49	18
Southern and coast prairie.....	0.40	Fayette.....	33	58,353	24,766	0.42	Chambers.....	122	140	91	0.65	8
Oak, hickory, and pine uplands.....	0.36	Robertson.....	66	49,554	18,080	0.36	Titus	59	9,305	4,923	0.52	13
Central black prairie	0.34	Collin.....	26	48,236	22,145	0.46	Delta	60	8,940	4,911	0.55	11
Northwestern red-loam prairie.....	0.24	Comanche	122	9,301	2,098	0.23	Wichita	131	103	43	0.42	87

Banner county of the state as regards total production: Fayette, 24,766 bales; banner county (a) of the state as regards product per acre: Bowie, 1,035 pounds seed-cotton; banner county of the state as regards percentage of tilled lands in cotton: Marion, 46.2 per cent.; banner county of the state as regards cotton acreage per square mile: Washington, 97.8 acres per square mile.

COMPARISON OF AGRICULTURAL REGIONS.—The Brazos alluvial region, which ranks as first among the cotton-producing regions (b) in average product per acre (900 pounds), has, on the other hand, but an average of 6.5 cotton acres per square mile, a large part of the region being at present unfit for cotton cultivation, because of its heavy, undrained soils. Fort Bend county produces the greatest number of bales, but Brazoria has the highest product per acre, 960 pounds. Since 1870 cotton production has increased with greater rapidity than the population, the percentages of increase being respectively 58 and 32, or as 1.8 to 1.

The Red river counties are next in product per acre, and the yield, 810 pounds, would no doubt be equal to that of the Brazos alluvial but for the large area of cultivated uplands, which reduces the general average of the region. The average cotton acreage per square mile, 36.1, is greater than that of any other region, and its production is 11.4 per cent. of the total for the state. Lamar county produces the largest number of bales, but Bowie ranks first, both in the region and state, as regards product per acre (excepting those counties whose production is less than 100 bales). In 1870 this region produced but 5.2 per cent. of the state's entire yield, but since then it has more than doubled its population and almost quadrupled its cotton production, the ratio of increase being as 1 of the former to 3.8 of the latter.

The long-leaf pine region, in the southeastern part of the state, while ranking next as regards product per acre, has but a very small area in cotton cultivation, the average being 3.4 acres per square mile, and this is confined mostly to the better class of bottom lands. Tyler county produces the greatest number of bales, but Liberty ranks first in the region in productiveness, viz, 735 pounds per acre.

The southern and coast prairie region both east and west of the Brazos river produces 13.3 per cent. of the cotton of the state, and the average product per acre is 608 pounds. The acreage of that crop on the east is but 5.9 per square mile, while on the west it is 13.7, but in the entire region it is confined to counties inland from the coast. Fayette county has the highest total production both in the region and in the state, while Chambers, with its very small cotton acreage, has the highest product per acre in the region. Since 1870 the increase in cotton production and population on the east has been very great.

The oak, hickory, and pine uplands, with an area greater than any other agricultural region, produces 40.4 per cent. of the cotton yield of the state, and has an average product per acre of 540 pounds of seed-cotton. The average cotton acreage per square mile is 0.29, that of population being 16.2. Robertson county produces the greatest number of bales, and Titus has the highest product per acre (780 pounds) in the region.

The central black prairie region now produces 31 per cent. of the state's entire yield, upon an average of 22.3 acres per square mile. The average yield per acre is 510 pounds of seed-cotton, Kaufman county ranking first in this regard, with an average of 880 pounds per acre. Sixteen of the thirty-nine counties forming this division each have an average of less than 450 pounds, that of ten counties lying mostly in the northern part of the region being above 600 pounds. Collin county produces the largest number of bales, an average of 690 pounds per acre, and ranks twenty-sixth in this regard among the counties of the state.

* Omitting those whose production is less than 100 bales.

b The Rio Grande valley is not included among these.

The red-loam prairie region of the northwest has but a comparatively small area under cotton cultivation, confined chiefly to those counties on the east that border the black prairies. The average product per acre is 360 pounds, an average less than in any other region. Comanche county produces the largest number of bales, and Wichita has the greatest product per acre (630 pounds). This and Archer county are the only ones of the region whose product is 600 pounds per acre.

ACREAGE PER SQUARE MILE.—The cotton acreage of Washington county averages 97.8 acres per square mile, the county ranking highest in the state. Fayette follows with 60.8 acres, then Johnson with 58.6 acres. Eight other counties, viz, Camp, Robertson, Ellis, Collin, Brazos, Harrison, Falls, and Fannin, have an average each of 50 acres and above; twelve counties average from 40 to 50 acres; seventeen counties from 30 to 40; twenty-three from 20 to 30; seventeen from 10 to 20; thirty-four from 1 to 10, and the other twenty-nine counties below 1 acre per square mile.

DISTRIBUTION OF PRODUCTION.—The county reporting the highest number of bales is Fayette, one of the southern prairie counties, and there are five others having a yield of above 20,000 bales each. These are Lamar and Fannin, on Red river; Collin and Dallas, of the northern part of the black prairie region, and Washington, adjoining Fayette. Eight counties have each a yield of from 15,000 to 20,000 bales, viz, Red River, Grayson, Cass, Harrison, Smith, Robertson, Ellis, and Colorado. Fifteen counties report from 10,000 to 15,000 bales, and all other counties below that number. Washington county has an average yield of 34.5 bales per square mile; a number far greater than in any other county of the state. Fayette county, which adjoins it, has a yield of 25.8 bales; Camp, in the northeast part of the state, 28.4 bales, and a few other counties above 24 bales per square mile, but all others are much below.

A region of low production is comprised in the counties of the long-leaf pineries and coast prairies east of the Brazos, the average number of bales being about 1.4 per square mile, though unequally distributed. Northward from this region to the Red river the average is much greater, about 10 bales per square mile. The greatest part of the cotton of the state is produced in the region west of the ninety-sixth degree of longitude, and includes the counties south from Fannin, Grayson, and Cook counties to Washington, Fayette, and Colorado, inclusive. The counties along the Red river have a yield equal to any except the very highest.

By reference to the cotton acreage map it will be seen that a region of intense cotton culture (from 15 to 20 per cent. of the total area) lies in Washington county; that a region of from 5 to 10 per cent. of the total occupies a very large area from the Red river southward in the central part of the state to the parallel of latitude 29.5, and another of the same percentage embraces a number of counties in the northeast; and that southward to the coast and eastward the relative acreage diminishes in broad belts.

PRODUCT PER ACRE.—In 1879 there were produced 805,284 bales of cotton upon 2,178,435 acres, which gives an average of 0.37 of a bale per acre. Assuming that the average bale contained 500 pounds of lint (as reported by correspondents), the yield per acre is found to be 185 pounds of lint, or 555 pounds of seed-cotton. The secretary of the cotton exchange at Galveston, however, reports that the average of all the bales received at that port in the season of 1879-'80 was about 513 pounds, which, if an average for the state also, would make a yield per acre of 189 pounds of lint.

The ratio between seed-cotton and lint varies greatly with the character of the land and the time of ginning. On rich lands the seeds are heavier, and therefore for a given amount of lint a greater weight of seed-cotton is required. The same is true as regards ginning, a larger amount of seed-cotton being required immediately after picking (the seeds being greener) than if allowed to dry before being ginned. The usual and accepted ratio between seed-cotton and the lint that can be obtained from it is as 3 to 1. The variations from this ratio are mentioned in the county descriptions. The above is an excellent average of natural productiveness if we take into consideration the fact that the year 1879 was an exceedingly dry one (it being claimed that the crop was reduced one-third), and that, with few exceptions, the lands are unaided by the use of fertilizers.

The chief cotton lands comprise the rich bottoms of Red and Brazos rivers and the uplands of the state. The former, therefore, would naturally yield the highest returns, and we find the "banner county" of the state to be Bowie, on the extreme northeast; a county in which the uplands consist of deep sandy soils, with a prominent growth of short-leaf pine, and on whose Red river bottom lands cotton is chiefly produced, with an average yield of 1,035 pounds of seed-cotton per acre.

Cameron, on the Rio Grande, surpasses Bowie in yield per acre, but only 25 acres have been under cultivation in that county, and it should be properly omitted from the list of cotton counties.

Chambers county, on the lower Trinity, with its 140 acres of cotton, lying mostly in the river bottoms, ranks next to Bowie, its average yield being 975 pounds of seed-cotton. Brazoria, one of the Brazos or "sugar-bowl" counties, ranks third, with a yield of 960 pounds per acre. Thus with Cameron on the extreme southwest, Bowie on the extreme northeast, and Chambers and Brazoria on the south, we have the maxima of cotton productions at directly opposite parts of the state, and on each of the four great alluvial or river belts. Besides these, Matagorda and Lamar counties, whose cotton lands are located chiefly on river bottom lands, have each a yield of from 900 to 915 pounds of seed-cotton per acre.

Eleven counties of the state have average yields of from 750 to 900 pounds, viz, Polk, San Jacinto, Jefferson, Fort Bend, Wharton, Delta, Red River, Fannin, Titus, Dallas, and Camp; thirty-two counties have an average of from 600 to 750 pounds, and forty-nine from 450 to 600 pounds; all others below that amount.

COTTON PRODUCTION IN TEXAS.

SHIPMENTS.—Farmers usually haul their cotton to the nearest market as soon as a few bales have been ginned, and, if pressed for supplies, they sell immediately. It is the general custom to sell to cotton buyers at these markets, and thus avoid the troubles of transportation, commissions, etc., though the larger planters prefer to ship to the commission merchants in the cities. Some of the eastern mills have adopted the plan of sending buyers into the country towns, and thus get their supplies direct from the farmers, paying the quotation prices, less the cost of transportation.

Galveston and Houston are the chief points from which shipments of cotton are made to New York and other markets of the United States, as well as to those of foreign countries. From Galveston the exports are mostly to foreign markets direct, the greater part going to Great Britain. New York receives the next largest bulk of the cotton, about one-fifth of the whole shipments being almost entirely by ocean routes.

Houston, though properly an inland city, is connected with the Gulf by Buffalo bayou, whose channel has been deepened and straightened sufficient to afford water passage for Morgan's Gulf steamers to within a few miles of the city, a short railroad completing the connection. Cotton is mostly shipped direct to New Orleans by this route, that intended for foreign markets going to Galveston by rail. A line of railway also connects Houston with New Orleans direct. The cotton bales are reduced to one-third of their bulk, preparatory to shipment, by steam compresses located in each of these cities, the cost being borne by the transportation companies.

The rates of transportation to New York were (in 1879) about 65 cents by rail, 50 cents by steamship, and a little less by sail per 100 pounds. To Liverpool the rates were $\frac{1}{2}$ d. by steamship and $\frac{3}{4}$ d. by sail per pound.

The following statement regarding receipts and exports for 1879-'80 have been furnished by the cotton exchange of Galveston. The season is from September 1, 1879, to August 31, 1880:

Comparative statement of cotton shipments from Galveston.

	Bales.
Net receipts	480,352
Receipts from New Orleans (a)	933
Receipts from Indianola	4,290
Gross receipts	485,575
Exports to Great Britain	213,243
Exports to France	23,831
Exports to the continent	49,679
Exports to channel ports	9,282
Total foreign	296,035
Exports to New York	116,466
Exports to Morgan City	49,574
Exports to other United States ports	14,163
Exports north by railroad	9,058
Total coastwise	189,261
Total exports	485,296
Average weight	501 15-100
Date of first bale	July 12
Where from	Yorktown, De Witt county.

In the northern part of the state cotton is largely shipped by rail to Saint Louis at about 90 cents (from Dallas), or to New York at \$1 34 per 100 pounds. If intended for foreign markets, it is sent to Galveston, at \$4 50 per bale. The rates of transportation from minor points are given in each county description.

ANALYSES OF THE SOILS OF THE STATE.

The table on pages 54 and 55 comprises the analyses that have been made of the soils of the state. The specimens taken represent as nearly as possible the most important regions, and were mostly collected by myself. The most important results of these analyses, as regards percentages of each of the chief elements of plant-food, viz, potash, phosphoric acid, lime, and vegetable matter, may be thus briefly summarized:

Potash.—In the light sandy soils of the northeastern counties of the timbered lands potash is somewhat deficient. While the minimum percentage is reached in the Bowie county uplands (0.047), the maximum in the region (0.195) is found to be in the most southwestern soil analyzed, viz, that from Bastrop county. The soils of the cross timbers have still higher percentages.

The soils of the red lands of the region show the same maximum on the southwest (0.718 in Lee county), due probably to the presence of Tertiary greensand rock in the neighborhood.

In the central black prairie the percentages of potash are large, especially in the soils from Collin on the north and McLennan and Falls counties in the center, representatives of the best class of black waxy lands of the state. That from Falls is surpassed but by two soils of the state in its potash percentage, viz, those of the Rio Grande valley and Oyster creek, in the Brazos delta. These prairie lands are stiff and difficult to till, while the black sandy soils of the same region are easy, and have also a sufficiency of potash.

The lands of the southern prairies, as well as those of the northwestern red-loam region, are adequately supplied, while those of the various alluvial regions surpass, as a whole, any of the soils of the state in their percentages of potash. The Rio Grande valley is remarkable in this regard, its proportion of 1.308 being the greatest of any soil within the state, due probably to extensive beds of greensand along the river, northward from Rio Grande City, there being also but few tributary streams to dilute with sands and clays the washings from these beds.

Phosphoric acid.—This most important fertilizing element is present in minimum quantities in the upland soils of Bowie county, on the northeast, and of the upper and lower cross timbers, as well as in the subsoil of the former. In the other soils of the timbered region, both gray and red, and the brown-loam prairies that are interspersed in it throughout many of the counties, there is a fair percentage, except in Smith county, where it is unusually high. The black lands of the central prairies vary greatly, the percentages of phosphoric acid ranging from low to inadequacy in the black sandy prairies of Ellis and the black waxy soils of Collin, to fair in the soil from Van Zandt and Johnson, and extraordinarily high in McLennan, Falls, and Lampasas. These latter are the highest for the state, and phosphate manures will manifestly not be required in a very long time for soils of such high percentages.

The southern and coast prairies, though consisting largely of black, tenacious, and calcareous soils, are comparatively deficient in phosphoric acid in Washington, rather low in Victoria, and fair in the other counties. These prairies will soon require phosphate manures in cultivation.

The river lands of the state, while, as a rule, having a fair amount, cannot be said to be rich in this element, with the exception of the Brazos bottom, southward from Hearne, whose alluvium contains the unusually high percentage of 0.370, thus ranking third in the state. The same land on the northwest is rather deficient in phosphoric acid, probably due to the fact that the valley is there narrow and more sandy from the washings of the bordering sandy uplands, as is also shown by the high per cent. of insoluble residue. The percentages are high in the San Saba river soil, and large in the Colorado soils at Austin and in that of the Rio Grande near Brownsville; the rest are generally from fair to low.

Lime.—As a stimulator and agent in rendering available the mineral elements above mentioned lime acts an important part, and, with humus, is a very essential ingredient in the soil. Based upon the estimate of Professor E. W. Hilgard (*American Journal of Science and Arts*, 1881) that the minimum amount of lime necessary to insure productiveness should not be less than one-tenth of 1 per cent., the soils of Texas, with a few exceptions, may be considered as rich in lime. Concurrently with large lime percentages we find large amounts of dissolved alumina and soluble silica, and, so far as a few determinations go, of humus, which is corroborated by the dark tint of the prairie soils. The red color of the alluvial soils would naturally make us suspect a large percentage of iron, but this does not appear from the analyses, the color resulting from the diffusion of the iron, imparting to the soil important physical advantages. We are reminded of the existence of the great gypsum beds at the headwaters of the rivers by the high percentages of sulphuric acid in the soils, especially in the alluvial lands.

Blight.—Much trouble is experienced by farmers throughout the state with what is termed "dying in spots", a blight that attacks all crops having long tap-roots. Cotton on such land suddenly dies in spots, or in areas varying from a few feet to as much as 50 feet or more in diameter, at a time when the plant has reached its usual height for fruiting and when the blooms are about to appear. Sometimes but a single plant dies in this manner, the others on all sides being healthy and vigorous. The decay begins usually at the lower extremity of the tap-root, proceeding upward to the surface of the ground, the growing plant showing no signs of trouble until the lateral roots are unable to furnish sufficient moisture. While this evil occurs on all lands throughout the state to a greater or less extent, it seems to be most prevalent in the heavy clay soils of the central black prairie region, which is underlaid by the compact and heavy-bedded rotten limestone.

Many theories have been advanced by farmers as to the cause of this decay, some claiming that "it is due to too much lime in the soil", an idea originating in the very general impression that all heavy soils are limy, because those of the black prairies contain much lime. That it cannot be due to this cause is apparent by the fact that cotton may often be seen growing well on lands full of fragments of rotten limestone, while dying on lands having very little lime in their composition.

That some plants are killed by other means, such as diseases and insects, is doubtless true; but from all the facts gathered on this subject, there is much more reason to believe that this dying in spots is chiefly produced either by ill drainage or by some cause that arrests the extension of the tap-root downward in its search for water and moisture. The tap-root of the cotton-plant is known to penetrate many feet into the earth, and it is not at all improbable that an impervious stratum of clay, or of the limestone, may be reached by a large number of the plant-roots, or that a rock may be in the way of a single root, thus producing the decay of a large area of plants or of the single plant.

Number.	Name.	Locality.	County.	Vegetation.	Depth.	Insoluble matter.	Soluble silica.	Insoluble matter and soluble silica.	Potash.	Soda.	Time.	Magnesia.	Brown oxide of manganese.	Peroxide of iron.	Alumina.	Phosphoric acid.	Sulphuric acid.	Carbonic acid.	Water and organic matter.	Total.	Hygroscopic moisture.	Temperature of absorption (C°).	Analyst.
	OAK, HICKORY, AND FINE UPLANDS.																						
	1. Gray sandy lands.																						
1	Sandy soil	Near Texarkana.	Bowie	Pine, oak, and hickory	12	95.197	0.977	94.174	0.047	0.036	0.274	0.102	0.075	1.035	0.282	0.090	0.015	.....	*1.456	99.046	1.760	18	R. H. Loughridge.
2	Yellow sandy subsoil	do	do	do	12-20	88.802	3.537	92.339	0.040	0.069	0.228	0.164	0.019	2.171	3.040	0.060	0.023	.....	2.074	109.233	3.900	18	Do.
3	Sandy upland soil	Mineola.	Wood	do	24	93.051	3.364	96.415	0.114	0.074	0.031	0.061	0.111	0.611	0.008	0.109	0.012	.....	0.611	99.117	6.740	13	J. B. Durrett.
30	Light sandy soil	Near Troop.	Smith	do	12	94.350	0.525	94.875	0.111	0.105	0.070	0.061	0.040	2.052	0.303	0.237	0.031	.....	2.035	99.026	1.071	13	Do.
31	Light sandy subsoil	do	do	do	12-18	93.453	1.820	95.273	0.148	0.080	0.090	0.091	0.121	2.337	0.779	0.295	0.105	.....	0.911	100.175	1.800	13	Do.
21	Sandy upland soil	McDade	Bastrop	Post oak and hickory	12	92.835	2.206	95.041	0.195	0.095	0.173	0.112	0.037	1.145	0.504	0.193	0.020	.....	1.057	99.173	1.637	17	Do.
17	Sandy soil	Cross timbers, Arlington.	Tarrant	Post oak and black-jack oaks	8	85.686	5.313	90.999	0.213	0.079	0.342	0.174	0.015	2.469	2.672	0.093	0.045	.....	2.785	99.886	4.435	13	H. McCalley.
26	Sandy upland soil.	Upper cross timbers, Leon river.	Comanche	do	12	96.360	1.176	97.536	0.209	0.058	0.038	0.206	0.031	0.497	0.671	0.121	0.030	.....	0.889	100.336	1.023	12	Do.
4	Dark loamy soil	Palestine	Anderson	Red oak and hickory	8	92.943	1.009	93.952	0.111	0.093	0.147	0.077	0.051	1.614	1.470	0.139	0.020	.....	2.201	99.929	8.781	14	J. B. Durrett.
5	Red sandy subsoil	do	do	do	8-12	79.934	1.251	81.205	0.067	0.060	0.168	0.012	0.170	8.478	6.078	0.194	0.006	.....	4.109	100.547	11.655	15	Do.
6	Red sandy soil	6 miles north of Lexington.	Lee	Not timber growth where taken.	12	74.983	3.885	78.868	0.719	0.131	0.258	0.530	0.032	9.333	5.801	0.103	0.028	.....	*4.717	100.018	7.833	12	G. E. Colby.
35	Dark pebbly soil	Linkwood	Gonzales	Post oak and hickory	10	60.770	13.606	74.376	0.446	0.077	0.389	0.209	0.043	9.623	7.944	0.233	0.106	.....	6.093	99.533	9.758	16	C. Cory.
	BROWN AND BLACK LOAM PRAIRIES.																						
34	Dark sandy prairie soil	2 miles west of Corsicana.	Navarro	Open prairie	10	87.557	5.183	92.740	0.117	0.070	0.320	0.191	0.033	1.638	2.394	0.220	0.110	.....	2.623	100.515	4.756	19	C. Cory.
7	Sandy prairie soil	Near Tehuacana.	Limestone	do	12	92.949	1.421	94.370	0.140	0.066	0.194	0.099	0.030	1.433	0.907	0.358	0.031	.....	2.124	99.832	3.499	13	J. B. Durrett.
	CENTRAL BLACK WAXY PRAIRIES.																						
15	Black waxy soil	6 miles north of McKinney.	Collin	Open prairie	12	45.145	17.241	63.386	0.619	0.186	7.484	0.839	0.409	4.216	11.073	0.151	0.104	1.875	9.510	99.852	17.013	13	H. McCalley.
27	Black sandy soil	Wills' Point.	Van Zandt	do	10	77.582	10.180	87.762	0.265	0.130	0.323	0.257	0.042	2.892	4.423	0.115	0.156	.....	3.608	99.983	6.366	14	R. H. Loughridge.
12	Black sandy prairie soil	1 mile south of Ennis.	Ellis	do	10	82.513	3.687	86.200	0.291	0.162	0.588	0.391	0.056	1.768	4.003	0.053	0.144	.....	*6.237	99.893	8.938	13	H. McCalley.
14	Black waxy prairie soil	2 miles west of Cleburne.	Johnson	do	12	60.354	5.563	65.917	0.365	Tr.	9.780	0.708	0.030	5.246	5.746	0.178	0.047	6.594	5.255	99.966	11.400	13	R. H. Loughridge.
36	do	South from Lampasas.	Lampasas	do	12	59.330	7.109	67.529	0.365	0.155	13.070	0.102	0.255	4.692	6.645	0.347	0.102	9.550	6.900	99.715	12.150	29	J. B. Durrett.
33	do	8 miles southwest of Waco.	McLennan	do	12	34.082	19.344	53.436	0.447	0.120	15.352	1.229	0.059	4.226	5.990	0.589	0.000	10.338	*7.592	99.478	14.530	13	R. H. Loughridge.
13	do	8 miles northeast of Marlin.	Falls	do	12	51.797	21.856	73.163	0.718	0.209	3.643	1.594	0.030	8.683	4.292	0.455	0.044	1.082	5.896	99.789	16.240	13	Do.
	SOUTHERN PRAIRIE REGION.																						
11	Black prairie upland soil.	Chapel Hill	Washington	Open prairie	12	75.530	12.183	87.713	0.235	0.145	0.948	0.477	0.056	2.266	4.161	0.108	0.075	.....	3.741	99.925	7.992	17	H. McCalley.
8	Black prairie soil	Schulenberg.	Fayette	do	12	74.172	8.126	82.298	0.374	0.209	0.965	0.968	0.162	3.802	4.639	0.163	0.332	.....	5.572	99.534	11.730	16	J. B. Durrett.
9	Sandy prairie soil	Pierce's Junction.	Harris	do	8	80.360	3.613	83.973	0.291	0.197	0.653	0.272	0.174	2.401	6.079	0.156	0.075	.....	*5.313	99.534	10.683	13	Do.
10	Black waxy prairie soil	Victoria.	Victoria	do	12	55.436	22.415	77.851	0.429	0.213	1.050	1.092	0.064	11.230	1.245	0.093	0.230	.....	*5.914	99.511	14.110	17	R. H. Loughridge.

NORTHWESTERN RED LOAM REGION.																		
Number.	Name.	Locality.	County.	Humus.	Inorganic.	Phosphoric acid.	Silica.											
16	Red sandy soil	Jacksboro'	Jacksboro'	10 74.945	8.651	83.596	0.425	0.103	0.125	0.882	0.150	5.050	5.076	0.095	0.047	4.805	100.354	10.840
ALLUVIAL LANDS.																		
38	Red clay, first bottom soil.	Red river north of Cooke county.	Indian territory.	12 65.765	6.618	72.383	0.405	0.030	2.932	0.623	0.085	4.681	8.361	0.156	0.020	1.707	6.998	100.382
39	do	Red river north of Lamar county.	do	12 68.050	9.883	77.913	0.345	0.066	1.116	1.217	0.126	5.274	8.367	0.209	0.030	0.952	4.906	100.521
40	Dark loam, second bottom soil.	do	do	12 76.560	9.100	85.660	0.404	0.089	0.466	0.619	0.169	3.296	3.246	0.163	0.077	5.758	90.947	6.777
25	Dark Trinity valley soil	2 miles west of Dallas.	Dallas.	10 36.065	16.553	82.618	0.509	0.225	10.344	1.602	0.054	3.837	5.205	0.152	0.188	12.008	6.270	99.002
19	Brazos valley soil	Granbury.	Hood.	12 88.177	2.151	90.328	0.298	0.081	0.413	0.343	0.040	2.076	2.508	0.094	0.020	2.735	98.936	6.026
20	Brazos valley subsoil	do	do	12-20 75.570	4.498	80.068	0.522	0.217	0.326	0.669	0.010	3.873	10.569	0.109	0.056	3.676	100.155	11.219
18	Brazos bottom soil	4 miles west of Hearne.	Robertson.	10 69.391	11.201	80.682	0.258	0.084	2.050	0.604	0.109	3.454	3.589	0.370	0.290	1.047	6.800	90.337
29	Red-loam soil	Oyster creek, east of Columbia.	Brazoria.	12 66.461	13.950	80.411	0.731	0.226	1.876	1.907	0.013	3.697	4.020	0.148	0.034	1.961	4.042	99.116
32	Black peach soil	San Bernard river, Columbia.	do	12 80.806	6.203	87.009	0.441	0.085	0.596	0.607	0.069	2.179	3.685	0.055	0.020	5.748	100.504	6.980
28	Red valley soil	San Saba river.	San Saba.	10 77.617	4.547	82.164	0.507	0.197	3.971	0.936	0.078	2.949	2.662	0.281	0.067	2.356	4.412	100.037
23	Colorado valley soil	4 miles east of Austin.	Travis.	10 62.306	10.357	72.663	0.581	0.118	7.793	1.379	0.126	2.934	3.238	0.207	0.033	5.075	5.928	99.225
24	Colorado valley cultivated soil.	do	do	8 87.088	4.654	91.742	0.393	0.077	0.459	0.447	0.108	2.068	2.045	0.086	0.026	Trace	2.376	99.324
22	Colorado valley virgin soil.	Bastrop.	Bastrop.	10 71.082	12.275	83.357	0.444	0.163	0.675	0.090	0.153	3.058	6.291	0.258	0.208	5.028	99.730	9.164
37	Rio Grande valley soil	Near Brownsville.	Cameron.	12 36.041	17.255	53.296	1.308	0.218	14.493	1.532	0.009	4.085	9.114	0.204	0.041	9.912	46.008	100.213

† Cultivated 40 years.

* See Humus table.

Determinations of humus and its available ingredients in some of the above soils (percentages referred to soils), by G. E. Colby, University of California.

Number.	Name.	Locality.	County.	Humus.	AVAILABLE—		
					Inorganic.	Phosphoric acid.	Silica.
1	Sandy soil	Near Texarkana.	Bowie	0.410	0.649	0.017	0.216
6	Red sandy soil	Six miles north of Lexington.	Lee	0.740	1.472	0.035	0.640
12	Black sandy prairie soil	One mile south of Ennis.	Ellis	2.250	2.010	0.040	1.184
33	Black waxy prairie soil	Eight miles southwest of Waco.	McLennan	2.304	1.996	0.039	1.275
9	Sandy prairie soil	Pierce's junction.	Harris	2.132	1.691	0.024	1.285
10	Black waxy prairie soil	Victoria.	Victoria	2.754	4.002	0.036	2.844
16	Red sandy soil	Jacksboro'	Jack.	0.898	0.460	0.014	0.208
39	Red clay, first bottom soil	Red river, north of Lamar county.	Indian territory	0.882	1.450	0.051	0.662
40	Dark loam, second bottom soil	do	do	0.732	0.056	0.056	0.308
18	Valley soil	Brazos river, Granbury	Hood	1.016	0.740	0.035	0.405
29	Red-loam soil	Oyster creek, east of Columbia.	Brazoria	0.714	0.585	0.034	0.214
32	Black peach soil	San Bernard river, Columbia.	do	2.658	1.296	0.055	0.502
23	Valley soil	Colorado river, east of Austin	Travis	1.688	1.579	0.041	0.659
37	Valley soil	Rio Grande river, Brownsville.	Cameron	1.465	0.951	0.041	0.659